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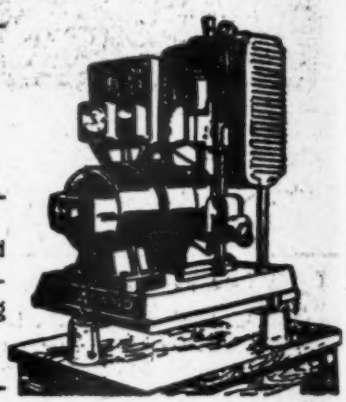

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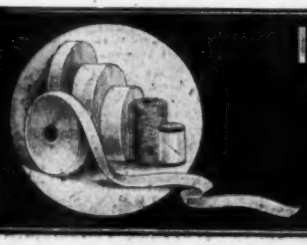

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THE STRUCTURE OF THE ATOM.

SCIENCE, which comprises what we know, has been likened to a sphere. If the surface of that sphere represent the area of contact with the unknown, the more we add to our knowledge, as measured by the bulk of the sphere, the more we increase the sense of our ignorance, as revealed by the growing area of its surface. There is something consoling about the image, seeing that the ratio borne by the surface to the content of a body diminishes as they expand. Nevertheless there is an element of desperation in the thought that our sense of ignorance must ever increase in spite of all we can do—indeed, by reason of all we succeed in doing—to remedy it.

These reflections are forced upon us by the survey of current developments in scientific research recorded in the proceedings of the British Association just concluded at Edinburgh. The early workers set out to explain the properties of matter—density, impenetrability, elasticity, chemical behaviour, &c.—and to do so they adopted the conception of discrete atoms which they next proceeded to endow with density, impenetrability, perfect elasticity, chemical affinity, &c. Now we find that each of these atoms must consist of a central nucleus called a proton about which are revolving electrons on a model not unlike that of the solar system. These protons and electrons appear to be dense, impenetrable, perfectly elastic, and electrical in behaviour, &c. There are some problems to the solution of which we seem never to come near. The resolution of the atom into a composite system of moving parts, however, explains a vast number of facts. We can mention but a few. The association of atomic weights and chemical affinity is loosened in accordance with the results of recent investigation and the existence of isotopes explained. The atoms can be placed in order according to the number of their parts, and in that order are to be found exactly appropriate places for numerous atoms having the same chemical properties but different atomic weights. A vast new realm thus swings into our ken. For example, the nearness of the figures obtained by all investigators for the atomic weight of chlorine is found to arise from the fact that all samples are derived from the sea, in which the several isotopes we call chlorine may be expected to have been most thoroughly mixed. Again, ordinary lead is also a mixture, but lead derived from the break-up of radium atoms is of one kind only, thus furnishing a clue to the quantity of radium that has undergone disruption in the past. A new light is thus thrown on the age of the earth, and the period which can be imputed to the geological changes that have occurred is vastly increased. Indeed the questions for which the new knowledge gives promise of solution are too numerous to mention or even to surmise. Speaker after speaker at the British Association meeting testified to the immense domain of science that had now been brought within our reach. However, the number of fresh questions that arise to confront us seems larger still.

To say that we find the problems associated with the solar system again presented to us in every atom would

be an inadequate presentation of what is in fact opened up by recent investigations as to the constitution of matter. The central proteon does not merely attract like the sun according to the law of inverse squares, its action upon surrounding electrons varies in zones from attraction to repulsion according to a law yet to be determined. The revolving electrons, it is true, are limited to eight for each zone, but the number of possible zones is not yet known. Unlike the single simplicity of the solar systems we are acquainted with, which, being separated by distances representing hundreds of light-years, develop in isolation, the atoms join up, share out their electrons on principles accounted for by the phenomena of valency in chemistry, and carry out their evolutions at such a speed that we cannot suppose the masses of the bodies concerned to remain constant. It is as if our planets were capable of developing velocities approaching 100,000 miles a second, so that we should have to allow for alterations of their mass as provided by the theory of relativity. Of course, these proteons and electrons, though small, cannot be conceived as not consisting of parts. Hence we must expect to have something analogous to the tides, giving rise to phenomena like the secular acceleration of the moon. Our day is gradually getting longer and is, in time, to increase to some 1,500 of our present hours. By that time the moon will have receded considerably. Possibly if it could break away altogether we should have something analogous to what happens in the radium atom when its constituents are expelled as rays.

Perhaps the simile with which we began is not so appropriate as we thought. It might be better to liken our knowledge to the surface of the sphere and our ignorance to its volume. The two being then conceived as expanding together might serve to illustrate the change in the ratio between them more closely in accordance with the actual facts.

Factory Lighting.

One of the aims of manufacturers in these days of high wages is the increase of production, and any increase which may be obtained without stress upon the operative is doubly welcome. The approach of the winter season and the consequent curtailment of "summer-time" renders it necessary to carry on with an increased proportion of artificial light, which normally has an adverse effect upon production. Much has been written and said by firms interested in pushing the sale of commodities accessory to good lighting, and we have noted pamphlets and reports circulated by unbiased authorities; throughout mention is made of the advantages accruing from the intelligent application of modern lighting units. A pamphlet which has recently been issued by the Home Office* emphasises the increase in quality and quantity of work produced when the attributes of good lighting, natural or artificial, are present; the health, safety, and efficiency of the worker are also dwelt upon. A *précis* is given elsewhere in this issue, but we consider that employers and employés alike should obtain a copy, since it is probably the most concise statement of the case that has ever appeared.

We have always championed the cause of good lighting in the belief that it is to the benefit of all concerned; we have also drawn attention to the superiority of electric lighting over all other forms of illuminant, but we have seldom seen the case presented in so forceful a manner as in the pages in question.

An interesting point in connection with the pamphlet is the recognition of the lighting engineer and the suggestion, made more than once, that he be consulted in order that the best effect may be obtained. We believe that the electrical industry has a long lead over the gas world in this respect, electric lighting being much more adaptable to circumstances and lending itself to the exactitudes of modern conditions, without undue risk and cost, so that its application has attracted the minds of thinking men.

The fact that this statement from a Government source follows closely upon the second report of the Departmental Committee on the Lighting of Factories and Workshops would indicate that our legislators may be called upon at no distant date to give effect to the recommendations of the Committee. If this surmise be correct, we may anticipate a tremendous step forward in the standard of artificial lighting obtaining in this country, and there can be no doubt that the indirect benefits to British trade generally, which are bound to result, will be immense.

*Welfare Pamphlet No. 7. Lighting in Factories and Workshops.

Million-volt Transmission.

The remarkable feat of the American General Electric Co., reported in our last issue, of transforming up from 2,000 volts to 1,000,000 volts at 60 cycles with apparatus designed on normal lines, has gained a good deal of attention in the lay Press on the ground that "according to the claims of the engineers . . . electrical energy can now be transmitted on a commercial scale over a distance approximately of 1,000 miles" (*Daily Telegraph*). "Approximately" is good. It is stated that the spark gap was "gradually widened, until at last a brilliant blue flame was leaping 15 ft. through the air," and it will be readily realised that when one is dealing with young lightning of this sort something quite special will be required for the line construction. The engineers, according to the published reports, used "hollow wires" 4 in. in diameter, and claim that transmission can be accomplished at 1,000,000 volts without losing too much energy by leakage (mainly corona effect, presumably) *en route*.

The highest voltage at present in use, we believe, is 165,000 volts, and the Southern California Edison Co. is about to conduct experiments at 220,000 volts, with a view to transmitting half a million kilowatts from the San Joaquin river to Los Angeles, a distance of 240 miles (Electrical Review, July 1st, 1921, p. 31). Flashovers have occasionally been experienced on the existing line at 150,000 volts. The step in pressure to one million volts is obviously a very considerable stride, and a great deal of investigation and experiment will be necessary before the system can be regarded as technically feasible, let alone "commercial."

Assuming, however, that the technical problems are solved, the question arises whether transmission over such a distance as "approximately" 1,000 miles will ever be called for in our time. The tendency is for industries to migrate to the neighbourhood of hydro-electric power stations, and though they often cannot be conducted in the near vicinity owing to topographical difficulties, it appears to us unlikely that suitable sites will not generally be found within, say, 300 miles of the source of energy. Undoubtedly there are immense hydraulic resources available within that radius of suitable sites, and the tendency will be to utilise these, wherever they are found, before embarking on projects involving transmission over greater distances. Some day the great powers running to waste far in the interior of South Africa and South America may, perhaps, be harnessed; but by that time, possibly wireless transmission of energy will have been achieved. If the energy of the atom is brought under control, of course, all such long-distance projects will cease to have *a raison d'être*.

Admitting that we have not at hand authenticated reports of the actual statements of the G.E. Co.'s engineers, we can only suggest that the use of 4-in. tubular conductors for overhead transmission is fantastic; that in any case the capital cost of a super-pressure transmission line of 1,000 miles is commercially prohibitive so long as coal supplies hold out; and that the risk of obsolescence of the whole scheme due to the progress of science would deter any competent financier from sinking immense sums in long-distance transmission lines.

ELECTRICITY IN MINES.

By M. I. WILLIAMS-ELLIS.

These days of labour unrest, culminating in the great coal strike, a disaster for both labour and capital, which hit our trade more than any war could, and caused suffering to the public at large, not to mention the loss of wages to the trades dependent on the output of our collieries, give many of us engineers food for thought as to the future production and output per man required to enable this country to compete in the open market with other countries. The facts one has to face are short hours of work in many industries, reduced output per man per hour, heavy increases in wages, and high minimum wages, all resulting in increased cost of production and consequent loss of trade. No State help in the form of subsidisation or nationalisation can ever make production; it rests entirely on the individual and the machinery of the concern. As an individual is his own engineer, good, bad, or indifferent, the problem we are left with is the machinery; how to get the best and most efficient results, *i.e.*, increased production of goods, at a marketable value.

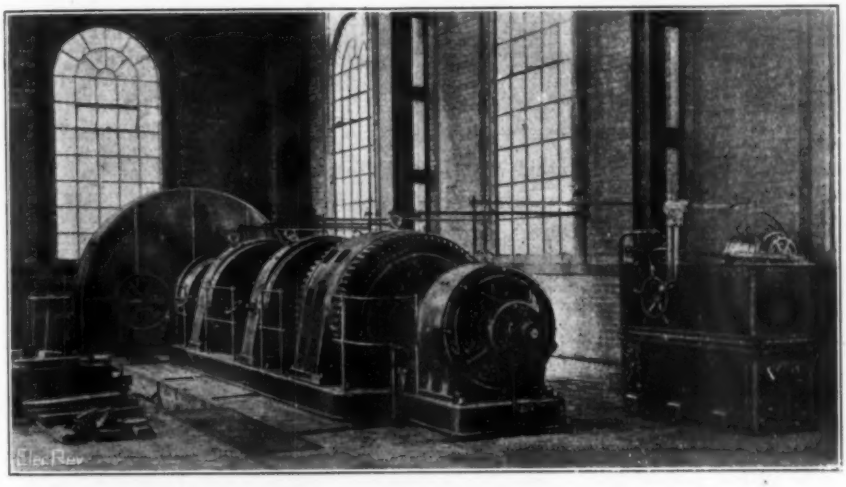


Fig. 1.—British Westinghouse Ward Leonard Flywheel Set.

Electricity stands foremost as a productive power to-day, and already with what little we know of it, its influence is felt more and more in every industry, with world-wide, far-reaching results yet to come. It will, however, in this article be sufficient to see how far its adaptability may be utilised in conjunction with winding, hauling, coal-cutting, and electric traction, &c., all with the idea of increased output, over that of methods perhaps in too many instances obsolete. One cannot lay down any hard and fast rule, as conditions vary both in industries and in districts, so that one can only write broadly on the subject, leaving the initiative to those in charge.

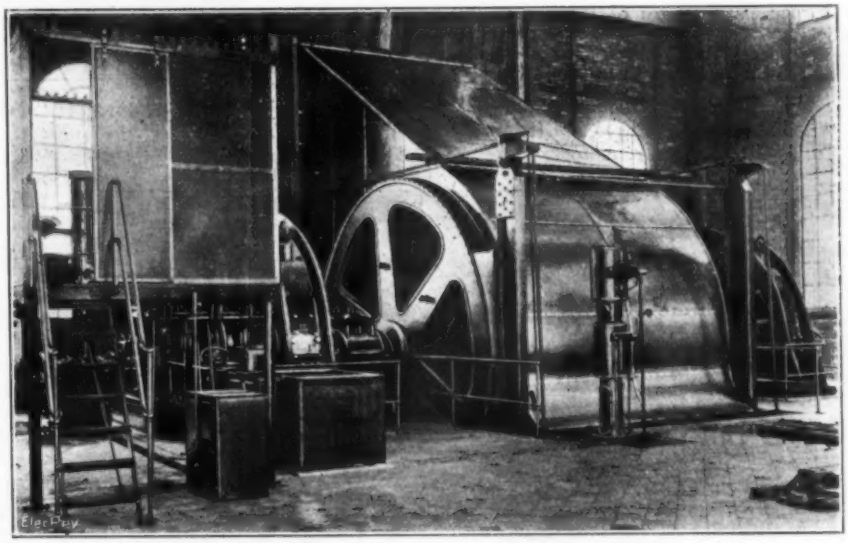


Fig. 2.—British Westinghouse 1,800/2,700 h.p. Electric Winder.

Electric Winding.

While the time has passed when it was necessary to advocate electrification to the colliery and mine engineer, the mine manager must always bear in mind that his electrical transmission must be justified by one of two reasons, if not both. One is economy of steam, and the other is convenience or safety.* For underground work, convenience is often of itself an adequate excuse, but for surface work, convenience is not often a sufficient reason for adopting electrical transmission on a large scale. It is, therefore, necessary that economy should be proved. The large colliery winding engine has stood by itself, and up to the present it may be said that in many cases it has not been practicable to substitute an electric winder for the steam winder. Winders to-day reach 2,000 and 3,000 h.p., which means that only large central power stations can supply the demands, a winder giving the most fluctuating of all loads. In the case of small winders the matter is different, as a power station which would not be equal to supplying 3,000 h.p. at a few seconds' notice might easily supply an extra 200 or 400 h.p. for a few seconds. In the matter of winding electrically we are sadly behind, although we trust not for long, if the contemplated

* But let it be remembered that the position is this:—If coal costs nothing, steam winding is cheaper; if coal is valuable, there is a particular value of coal at which the two are equally cheap. As the price of coal advances, so does the balance swing in favour of electric winding, and more so than ever to-day with the present short working hours, the shortage of skilled miners, and the curse of a high minimum wage.

super-power schemes materialise. To give some idea of the cost of winding electrically in this country, one may mention the case of a 360-h.p. "Witton" motor driving a winder for the Midland Coal, Coke & Iron Co., raising coal 450 yards at a cost for energy of 4s. 2d. per 100 tons.

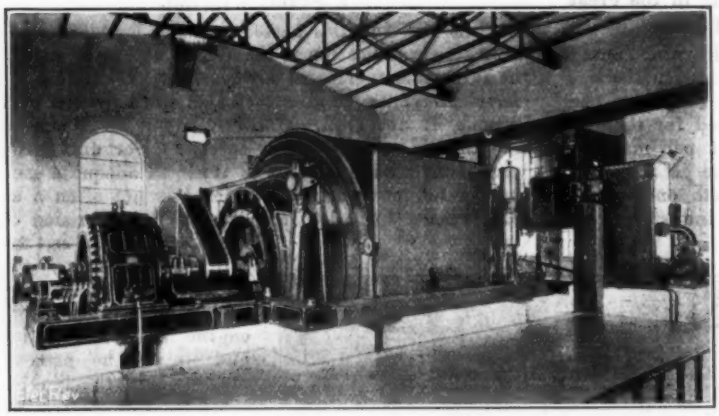


Fig. 3.—British Westinghouse a.c. 700/1,500-h.p. Electric Winder.

The accompanying illustrations give some idea of modern electrical winding practice.

Fig. 1 shows a Ward Leonard flywheel set, built by the British Westinghouse Company (now known as the Metropolitan-Vickers Electrical Co., Ltd.), supplying power to a winder at the Great Western Colliery Co.'s Cwm pit. In fig. 2 is shown the electric winder above mentioned, fitted with two d.c. motors of 1,800/2,700 h.p., direct coupled, and winding a net unbalanced load of 26,880 lb. at a speed of 1,640 feet per minute, from a shaft length of 2,250 feet, the drum being of the cylindro-conical type with diameters of 12 feet and 18 feet.

Fig. 3 is a view of a British Westinghouse electric winding engine at Hordon's Colliery Co.'s pit, fitted with an a.c. 700/1,500-h.p. geared motor, winding a net load of 7,050 lb. at a speed of 2,650 feet per minute from a shaft length of 1,350 feet, with a drum of the cylindro-conical type, 10 and 20 ft. in diameter.

Fig. 4 illustrates a Sandycroft cascade a.c. two-speed hoist of 700 h.p., working at 485 and 325 r.p.m.

Fig. 5 shows a winder installed at the Burley Pit of the Midland Coal, Coke, and Iron Co., driven by a G.E. Co.'s "Witton" a.c. motor.

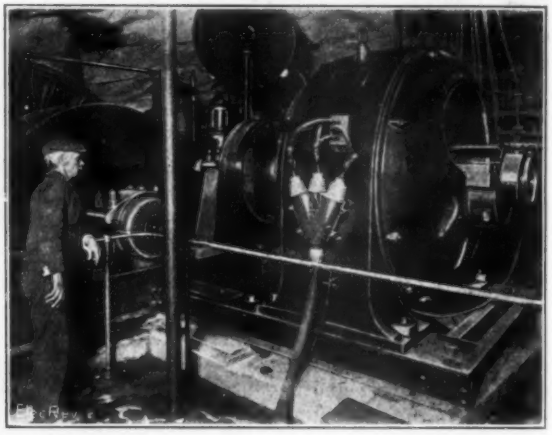


Fig. 4.—Sandycroft "Cascade" a.c. 700-h.p. Two-speed Hoist.

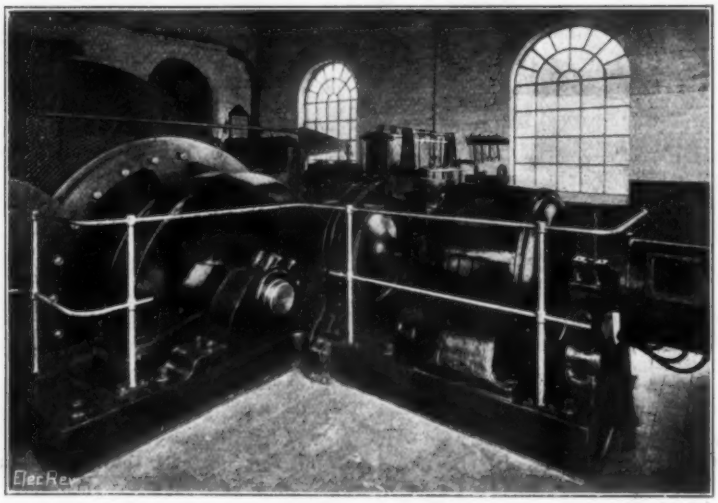


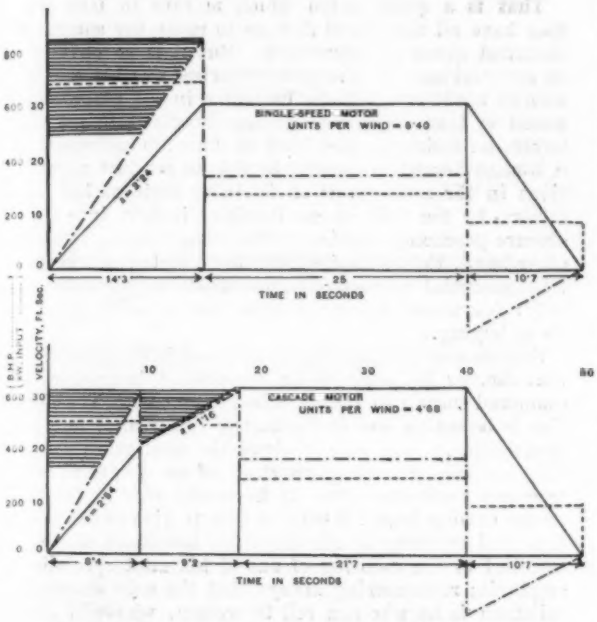
Fig. 5.—General Electric Co.'s "Witton" a.c. Winder.

As regards electric winding, a great deal may be learnt from our own Colonies, South Africa especially; the whole of the winding on the Rand is carried out electrically, giving highly efficient results, the power being derived chiefly from the Victoria Falls Power Co.'s steam-driven generating stations. There are many systems of winding plants, differing in the design of the electrical and mechanical gear, and all having their special advantages.

It is now a proved fact that provided capital expenditure can be kept down, and the demand for power is supplied as and when required, there is a large saving in energy consumption, running costs, and wear and tear in connection with electric winding. There are many contemplated winding schemes held up to-day solely on account of the high prices that have to be paid for new plant as a result of high wages and general upset of labour conditions. When once these factors again become normal, one will undoubtedly see mining more economically carried out than ever before. Small electrical winding and hoisting plants are far and away more efficient and applicable than many other means of winding, they can be placed right up against the working point at any reasonable distance from the power supply, at low cost, and with high efficiency, and moved quickly to any other point, at little expense, when necessary. In the writer's mind, too little consideration is given to the economical speed of hauling or winding, in either mines or quarries, and many examples could be given of small production in consequence of slow winding. In some cases the motor is too small, the shaft or incline in too bad a condition, or power not available. The economic speed in each case, and for each class of mine, can be carefully worked out, and hinges on the following conditions: The directors knowing what can be spent, the manager knowing what he wants, the engineer knowing what he can do, and, last but not least, the miner knowing what he can produce, and doing it.

It may be interesting here to give a comparison between single and two-speed winding, the cascade system being adopted for the latter, which has specific advantages over the former. One of the chief points is a reduced peak load with the two-speed system, as may be

shown from the actual curves, with a reduction of energy consumed per wind, see figs. 6 and 7. For incline haulages, the writer has found the two-speed machine of great use in special instances of variable inclines; on the small angle of incline the motor is



Figs. 6 & 7.—Comparisons of Single- and Two-speed Winders.

Speed ———; kW input - - - -; b.h.p. — . — . — . —. The two-speed "Cascade" motor takes a peak load 27% less than that of the single-speed motor, and the energy per wind is 14% less. The shaded portions show the losses in resistance; single-speed 4,935 kW-seconds, two-speed 2,890 kW-seconds.

used at top speed, and on the high angle of incline, the motor is worked at bottom speed, while where high speeds are possible for rock a lower speed is permitted for men.

(To be continued.)

THE TEST OF SALESMANSHIP.

By H. R. TAUNTON.

Electrical engineers and women move normally on different planes. It is, perhaps, one of the advantages of being an electrical engineer. But there is, nowadays, one point at which their orbits coincide—the electrical accessories showroom.

The contractor himself generally sheers off in a parabola, and leaves the meeting to an unhappy junior. He would be wiser if he stayed, if only to learn from defeat. If his courage fail him so far, it is at least essential, in view of the increasing importance to him of the sale of accessories, that he depute the care of his showroom not to a junior, but to an expert, capable—or as capable as mere man can hope to be—of facing undismayed "the tempestuous petticoat." For that is the true test of salesmanship.

Any fool can sell anything to a man. The average man only enters a shop from dire necessity. To buy, for instance, his tobacco. Generally he has to be lured in by seeing what he wants actually displayed in the window. But in any case he knows exactly what he wants. If you have it, or something reasonably like it, the transaction is ended in a minute. But even if you haven't, he is usually far too timid to refuse something "just as good." Few men have the moral courage to leave a shop without buying something, by way of apology; and most of them spend far more than they intended.

Now, a woman enters a shop in a spirit of reckless enterprise, heedless of what she wants, or whether she wants anything. On the other hand, she has very clear and decided opinions as to what she doesn't want. She will watch you dismantle the showroom, and gut the stores, in search of the nebulous something she may want, and consider you well repaid if she thanks you before leaving, empty-handed, to favour somebody else with her custom.

It is quite useless to show her anything you think she ought to want; quite useless, even if you succeed in producing the article she really does want, to try and persuade her to spend more on it than she has decided it ought to cost. A woman shopping has no heart; she is the hard-headed business man, with a tight clutch on the purse strings.

It takes an expert salesman to sell a woman something that she wants. To sell her something that she doesn't want is the rare achievement of genius.

Let not the contractor lose heart, however. There is big business to be done in the sale of accessories. The number of women who are discovering the potentialities of amusement in electrical showrooms is increasing daily—and some of them must buy something. You may as well sell it as the other man.

The first rule of success is to avoid technicalities. It is no good saying an electric iron "consumes 500 watts." A man will nod his head sagely, and pretend he knows all about watts. "Oh, yes. What's-his-names! Consume them myself. Prefer them to proteids for breakfast." He buys the iron in a hurry, and gets away before you begin babbling about volts and amperes.

A woman is more candid. She doesn't pretend to know what watts are, and doesn't want to. A futile jargon! If you persist in it she will suspect you of trading on her ignorance. No sale! The sound and simple method is to translate the consumption into pence, or, what will probably appeal more to her, into farthings. (Assuming, that is, that you have sufficient knowledge of the calculus to master the complexities of the local supply company's rates.) Tell her it will cost her three farthings an hour to use (don't call it ".75 pence," by the way); and you are giving her the facts in terms of everyday speech. And you are reassuring her on a vital point.

The use of domestic electrical appliances would be far more general were it not for the common impression that they are expensive luxuries. Supply companies, unfortunately, what with their complicated power rates, and their reluctance to give small power services, do little to remove that impression. When Mrs. Smith, after lightheartedly using an electric fire for a few weeks, gets in a bill for electricity exceeding the original cost of the article, she makes remarks about it to Mrs. Brown—who was going to buy an electric iron, but now decides it will be cheaper to engage another "tweeny." Of course, Mrs. Smith has had to attach her radiator to a lighting plug because the company won't be bothered installing a meter for so small a power supply. Nor will it adapt its lighting rates to encourage the use of accessories; and there you are! The company goes on grumbling about its day load, and the contractor watches his stock of nicely polished kettles and toasters getting tarnished, unsold.

Having persuaded the good lady that an electric iron, or kettle, or toaster is actually within the sphere of practical domestic economy, proceed to expatiate on the usual talking points. Be circumspect! She knows more about irons and kettles than you can ever hope to do. If you exaggerate in a single detail, or handle the truth a little carelessly, she will, with feminine logic, jump to the conclusion that the whole science of electricity is built on a foundation of lies. You will lose her confidence, and the sale.

Your only chance, then, is in the demonstration. Always demonstrate if possible. She expects it as part of the afternoon's amusement; and besides, it carries conviction better than all the eulogy in the dictionary. Seeing is believing.

Remember, again, in your demonstration, that you are performing before an expert critic. Even if you attempt no higher flights than the ironing of a handkerchief, or the boiling of an egg, go warily; or she will pull you up, and electricity will be damned in her eyes for ever. You may think boiling an egg a simple enough matter. You rely on your watch, of course; you check off three and a half minutes. A woman has no use for so scientific a process. She boils an egg by intuition. It serves her well; while your watch may let you down. Eggs have their idiosyncrasies.

There are lots of points, too, about an electric washer where you may be caught out, if you trust too much to the book of words. Times and temperatures and currents cut no ice with a practical woman. Thermometers make her tired. She tests the baby's bath water with her elbow, and gives the baby the thermometer to float the soap on. Degrees Fahrenheit, revolutions per minute, watts, amperes; cut them all out. Talk to her of soap and borax, flannels and silks; give her homely wrinkles in the use of the machine; and, having convinced her that you are familiar with the technicalities of washing day, you will the more readily convince her that you know what you are talking about when you dilate, later, on the electrical and mechanical perfections of your particular type of washer.

Plain, concrete facts such as that the clothes do not want soaking overnight, or that an average batch of soiled linen can be thoroughly cleaned in 15 minutes, will carry a conviction born of understanding; whereas your statement that the wringer has ball bearings, or that the copper in the motor is 100 per cent. Matthiessen's standard, will leave her cold, unless you have already succeeded in interesting her on practical points.

Try to prove to her that the average life of a washer is about 20 years, and that, therefore, it will only cost her per annum a twentieth of its price, and that this ridiculous amount is little more than the modern laundry's charge for mangling a pair of pyjamas. Do that, and you will make a sale—if she had made up her mind to buy before ever she entered your showroom!

In the same way, if you are trying to sell a vacuum cleaner, an ounce of understandable facts is worth a ton of theoretical fancies. A housewife will know the difference between a clean and a dirty carpet, even if her only idea of a vacuum is the emptiness inside the bag. Demonstrate with a strip of carpet and some fluff and grit well rubbed in, so that she can see for herself the carpet lifting to the nozzle, the brushes beating it down again and loosening the dirt, and the clean track of the sweeper. Appeal to the eye rather than to the ear.

An argument often used in selling electrical appliances is the saving in the cost of domestic labour. It is an argument that can easily be overdone. In these hard times, families with one or two servants are the rule. There are many who can afford to buy quite expensive electrical devices who cannot afford the luxury of a servant at all. It would be a very complicated electrical machine that would perform all the duties of a general in a middle-class household, and so really save the cost of her wages and keep. To say that an electric kettle is going to enable the lucky purchaser to dispense with the services of one of her two servants, savours of exaggeration. The sound common-sense of the housewife sees the fallacy, and will have none of it. And in a large household where, for instance, a complete installation of electric heating and cooking *might* save the labour of a housemaid, the argument has little value, for the mistress of such a household can afford to ignore it.

The more plausible statement that it saves part of a servant's labour, carries little weight, for, after all, one cannot dispense with the fractional part of a housemaid, and cut down the rations for what is left of her. And Mrs. Newrich doesn't see why she should "pay me gals their wages, and then buy electrical fads that'll only make 'em idle."

Indeed, the electrical showman must be prepared to hear and combat the most extraordinary arguments; often stupid and illogical; but as often, shrewd and practical. And "practical" must be his own watchword. The successful salesman must be the complete housewife, the modern Mrs. Beeton. One might call him a domestic electrical engineer, with all the accent on the "domestic," and little or none on the rest of the phrase. In short, "thoroughly domesticated."

That is a qualification which is rare in men who may have all the others that go to make the successful electrical showroom attendant. But it is so obviously an essential one that the question arises whether a saleswoman would not perhaps be better in his place. She would at least be able to discuss details with possible buyers on their own high level of domestic technicality. A woman herself, she would be able to conduct negotiations in the same terms of feminine logic as her customers, by the light of an intuitive insight into their obscure psychology denied to the obtuser male. On the other hand, the average woman lacks certain characteristics essential to good salesmanship. To mention one only: few women bring the same rest to selling as they do to buying.

Saleswoman or salesman, whichever it be, it is clear that she, or he, must be an exceptional individual to command success in the electrical showroom. The position is becoming one of increasing importance and responsibility. The sale of domestic appliances is developing into a large proportion of an electrical contractor's total turnover. If he would ride to fortune on the coming boom, it behoves him to give to the selection and training of his showroom attendant the care essential to the choosing of one of his most specialised employés; remembering always that the only successful salesman is he who can sell to women, who will form to-morrow, if they do not to-day, the majority of his customers.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR AUGUST, 1921.

The August returns of electrical export and import business which we publish herewith show some falling off all round as compared with the July figures. The exports reached the total value of £1,284,511, as compared with £1,565,545 for July, a decrease of £281,000.

The only satisfactory sections of electrical export returns were insulated wire and electrical machinery unenumerated in which increases of £43,000 and £40,000 were recorded, decreases occurring in all the other items, the largest being £266,000 in the submarine cable section.

The imports total of £140,334, compared with £170,673 for July shows a decrease of about £30,000, a falling off occurring in all items with the exception of meters and telegraph and telephone instruments and apparatus.

The re-exports total of £14,557 was £25,000 less than the preceding month's return.

Values of Electrical Exports and Imports for August, 1921.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus ...	£131,478	£35,113	£3,122
Insulated wire	224,449	11,581	—
Glow lamps	33,384	7,935	287
Arc lamps and parts	2,597,934	887	75
Batteries	46,927	2,959	—
Meters	36,093	9,108	1,303
Carbons	3,101	4,573	2,497
Electrical machinery :—			
Railway and tramway motors ...	21,554	—	—
Other motors and generators ...	217,052	—	—
Switchboards (not telegraph or telephone)	23,190	20	636
Electrical machinery (unenumerated)	169,985	48,362	2,732
Telegraph and telephone cable and material :—			
Telegraph and telephone wire and cable (not submarine) ...	118,078	4,377	353
Submarine telegraph and telephone cable	72,491	—	—
Telegraph and telephone instruments and apparatus	183,200	15,419	3,552
Totals... ...	£1,284,511	£140,334	£14,557

THE KINGSWAY WIRING SYSTEM.

We have received from the General Electric Co., Ltd., particulars of the "Kingsway" wiring system, which the company has developed with a view to reducing the number of parts and special accessories to the minimum, whilst complying with all the requirements met with in wiring installations. It is claimed that the new system is simple, easy to install, not unsightly, safe in operation, and moderate in cost. Lead-sheathed wire and cables are employed, of the company's L1 grade, specially manufactured at the Pirelli-General Cable Works, Southampton, 600-megohm class, insulated with pure and vulcanised rubber, and having from one to three cores, carrying from 6 to 18 amperes (I.E.E. rating). The wires are fixed to the walls with saddles or wiring clips, the latter being of tinned brass with countersunk holes for the screws or fixing pins, so that injury to the metal sheath of the cable is avoided (fig. 1). The backplate is of tinned brass

Fig. 1.—The "Kingsway" Continuity Clip, Wire Clip, and Earthing Bar.

in the form of a wheel with spokes, fig. 2, and is provided with a centre screw, which acts as an earth terminal, and provides for fixing either the junction box cover or a wooden patrass. A nut and washers are provided for clamping the continuity clips, and large and small holes in the rim enable the plate to be fixed in any position.

The "Kingsway" junction-box cover, shown in fig. 3, is a stout stamping provided with slits in the wall, so situated that any number of entries up to four, of any size of cable, can be

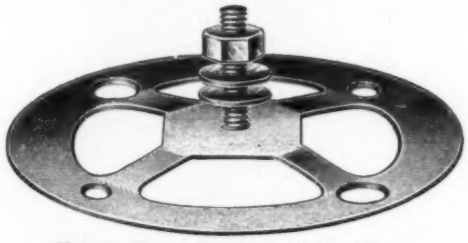


Fig. 2.—The "Kingsway" Back Plate.

accommodated by bending the tongues of metal upwards and inwards, without special tools. A milled nut is permanently secured to the cover, to fix it to the back plate.

Fig. 4 shows the back plate with cables and connectors in position and the bonding completed, and fig. 3 shows the cover in place. Bonding is effected with the aid of the continuity clip illustrated in fig. 1, which has two fixing holes, one for side entry and the other for back entry. Only one size of clip is required. Lastly, a special earthing bar, shown

Fig. 3.—Back Plate and Junction-box Cover with Wires in Position.

in fig. 1, is provided for use at the back of fuse and switchboards, and in other positions where it is necessary to bond several cables together; the bar is made of stout tinned brass strip, with an earthing terminal, and the connections are made with the continuity clip, attached with flat-headed countersunk screws.

It will be seen that the parts are few and simple, and no special training is needed for their installation, nor are special tools required. Ordinary ceiling roses, switches, &c., are used with them, and the appearance of the completed installation is neat. The makers have issued a new section (Section W (2)) of their catalogue giving full details and prices of the

Fig. 4.—Backplate, Showing Wires and Connectors in Place and Method of Bonding.

parts of the system, for which patents have been applied for, as well as of standard accessories for use in conjunction with it.

THE IMPORT TRADE OF BRAZIL.

The following figures showing the value of Brazil's imports of electrical and allied goods have been taken from the official returns. The corresponding figures for 1918 have been given for purposes of comparison, and notes of increases or decreases added:—

	1918. $	1919. $	Inc. or dec. $
Dynamos and electrical generators.—			
Total	222,000	203,000	– 19,000
From United States	140,000	141,000	+ 1,000
,, Great Britain	6,000	18,000	+ 12,000
,, Switzerland	74,000	39,000	– 35,000
Electric motors.—			
Total	188,000	597,000	+ 409,000
From United States	117,000	519,000	+ 402,000
,, Great Britain	8,000	22,000	+ 14,000
,, Switzerland	17,000	24,000	+ 7,000
,, Uruguay	31,000	17,000	– 14,000
Insulators.—			
Total	127,000	192,000	+ 65,000
From United States	108,000	160,000	+ 52,000
,, France	3,000	6,000	+ 3,000
,, Great Britain	8,000	9,000	+ 1,000
,, Portugal	7,000	14,000	+ 7,000
Electric lamps.—			
Total	726,000	1,046,000	+ 320,000
From United States	618,000	788,000	+ 170,000
,, Great Britain	7,000	33,000	+ 26,000
,, Netherlands	79,000	209,000	+ 130,000
Transformers.—			
Total	233,000	596,000	+ 363,000
From United States	213,000	578,000	+ 365,000
,, Switzerland	10,000	16,000	+ 6,000
Copper wire, electrical.—			
Total	346,000	637,000	+ 291,000
From United States	337,000	602,000	+ 265,000
Copper wire, unclassified.—			
Total	440,000	660,000	+ 220,000
From United States	421,000	628,000	+ 207,000
Copper wire, uninsulated.—			
Total	57,000	17,000	– 40,000
From United States	57,000	17,000	– 40,000
Electric wire or cable, n.o.e.—			
Total	675,000	727,000	+ 52,000
From United States	662,000	682,000	+ 20,000
,, Great Britain	4,000	13,000	+ 9,000
,, Italy	6,000	27,000	+ 21,000
Telegraph and telephone posts, bridge and fence material.—			
Total	33,000	161,000	+ 128,000
From United States	31,000	87,000	+ 56,000
,, Great Britain	2,000	74,000	+ 72,000
Machinery, industrial.—			
Total	1,411,000	2,528,000	+1,117,000
From United States	1,024,000	1,740,000	+ 716,000
,, Argentina	17,000	57,000	+ 40,000
,, Great Britain	141,000	571,000	+ 430,000

	1918.	1919.	Inc. or dec.
Motors, oil.—	$	$	$
Total	182,000	59,000	– 123,000
From United States	9,000	11,000	+ 2,000
,, Great Britain	2,000	20,000	+ 18,000
,, Switzerland	160,000	12,000	– 148,000
Engines, steam.—			
Total	39,000	36,000	– 3,000
From United States	20,000	19,000	– 1,000
,, Great Britain	—	11,000	+ 11,000
Pumps.—			
Total	188,000	313,000	+ 125,000
From United States	128,000	197,000	+ 69,000
,, Great Britain	29,000	70,000	+ 41,000
Other machinery, not textile.—			
Total	2,314,000	5,466,000	+3,152,000
From United States	1,488,000	4,081,000	+2,593,000
,, Argentina	160,000	84,000	– 76,000
,, Great Britain	259,000	774,000	+ 515,000
,, Sweden	145,000	141,000	– 4,000
,, Switzerland	63,000	103,000	+ 40,000
Machinery, electrical, n.o.e.—			
Total	2,662,000	3,285,000	+ 623,000
From United States	1,722,000	2,762,000	+1,040,000
,, France	7,000	45,000	+ 38,000
,, Great Britain	85,000	279,000	+ 194,000
,, Italy	94,000	55,000	– 39,000
,, Spain	39,000	42,000	+ 3,000

$5 = £1 approximately.

THE INTERNATIONAL DENTAL EXHIBITION.

Under the auspices of the Incorporated Dental Society, an International Dental Exhibition was held at the Horticultural Hall, Westminster, from September 12th to 16th. Electricity nowadays plays a large part in dental surgery, but, of course, the various makes of apparatus differ only a little—chiefly in purely mechanical details—and, as a consequence, there was a great amount of duplication of exhibits.

As an example of this we will instance the "Ritter" apparatus for producing X-ray photographs of dental subjects; this appeared on three or four stands. The principal agents for this—an American production— are Messrs. de Trey and Co., Ltd.

One of the largest exhibitors were Messrs. Claudius Ash, Sons & Co., Ltd.—Among the exhibits of this firm was a "Cases" dental X-ray outfit. This consists of a Coolidge radiator tube, with a life of 1,000 hours, fitted with a dust-proof lead-glass shield and a lead-glass focusing tube to give the proper distance for radio-photographs. The tube is supplied with power at 70,000 V by an oil-cooled transformer whose primary can be connected to a 100/250-V supply. A motor converted can be supplied for dealing with d.c. The tube holder is mounted on the top of the transformer cabinet and is easily adjusted. This apparatus is of British manufacture although of American origin. The ionic medication outfit shown by this firm consisted of a dry battery, to the terminals of which electrodes could be connected for the application of ionised solutions such as copper sulphate, and zinc chloride which are used by dentists. Another device shown was a thermo-electric hot-air syringe containing a small heating coil in an easily replaced cartridge. Electric-motor lathes for d.c. and a.c. at various voltages and frequencies were exhibited. These were equipped with brushes, small grinding wheels, and various other accessories. A number of small mouth lamps and reflectors also appeared, in addition to "Empire" high-frequency apparatus.

Messrs. Cottrell & Co. displayed and demonstrated high-frequency electro-medical sets, including the "Rogers" outfit. This is fitted with three "violet-ray" electrodes, cautery instruments, and an "ozone" attachment for giving a patient internal treatment. The set may be connected to an ordinary lamp socket and the current and pressure are regulated by small dial switches. Electrodes for special dental treatment are made in a variety of shapes. X-ray photographic units were also exhibited by this firm.

The Palatine Dental Manufacturing Co., Ltd., in addition to the inevitable X-ray photographic exhibit, showed the "Rayway" special reflector for dental operations. This gives a beam of pure white light about 6 in. in diameter by the agency of a gasfilled lamp. Another device displayed was a "Rayway" hard-soldered sterilised fitted with a triple heating element and a three-heat switch. The danger of melting joints due to overheating has been eliminated from this steriliser.

The Dental Manufacturing Co., Ltd., exhibited a number of electrical devices. Included among these were examples of "Rathbone" electric lathes and small current converters. The "Pentz" steriliser was also shown. This consists of a necked cylinder into which a cylindrical tray of perforated metal slides. The cylinder is heated by means of an electrical element. Mounted on the case is a small cup from which water drips through a glass tube into the heated chamber where it is evaporated. The instruments undergoing sterilisation are placed in the above-mentioned tray and reports of medical men testify to the efficiency of the method. This company also exhibited a high-frequency set for "violet ray" treatment, cautery, hot air, &c. Another steriliser shown by this firm, the "Thorne," was electrically heated and provided with an automatic switch, actuated by the melting of a fusible plug, to prevent overheating.

On this stand appeared a dental photographic outfit by X-rays, Ltd., which is illustrated herewith (fig. 1). The

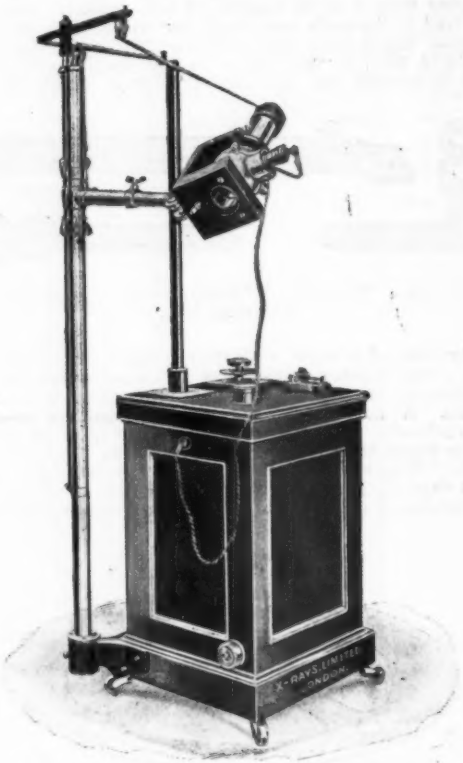


Fig. 1.—X-ray Dental Photographic Outfit.

cabinet contains a small step-up transformer which gives an output of 45,000 volts, and is designed for use with the special Coolidge dental X-ray tube, as shown in the illustration. There is only one high-pressure wire, and this is kept well out of the way of the patient, being led up through a stout ebonite tube. The other wire which lights the filament is at a low pressure, and no shock is experienced if the patient touches this. On the top of the cabinet a special switch is provided, the first stud of which lights the filament and the second turns on the high-pressure current. A milliamperemeter is fixed, which gives the milliamperage passing through the tube and a small sliding resistance in the lighting circuit allows this to be controlled, the output being from one to ten milliamperes.

Mr. Conrad H. Pinches displayed and demonstrated the "Adams" X-ray dental unit, which is provided with a special film holder ensuring correct angles in the taking of photographs.

In conclusion, it remains to be said that each year the number of members of the profession who take the opportunity of inspecting the exhibits grows; the exhibition is of a strictly professional character, the lay public being rigidly excluded.

German Cable Deliveries.—The Java newspapers announce the arrival at Bandoeng of Herr Engler, representative of the Norddeutsche Seekabel Werke, of Nordenham, in connection with the laying of new submarine cables in the Dutch East Indies. It appears that the Government of the Dutch East Indies has purchased about 2,900 kilometres of cable from this German company, which cable reached Priok at the beginning of August on the steamer *Flint*, together with a number of engineers, including Herr Gruno, the company's chief engineer. Dutch State engineers boarded the ship and were conveyed to the Dutch East Indies cable steamer the *Telegraaf*, which took the cable on board for laying between Singkel and Sibolga, on Sumatra, and two new cables were to be laid between Java and Sumatra in the Soenda Strait and then from Makassar *via* Donggala to Menado and from Makassar to Socraboja.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Watt-hour Meter Tester.

The Sangamo Electric Co. has recently placed on the market an improved type of portable test meter (fig. 1), intended for checking the accuracy of service-type watt-hour meters. The advantages of using this type of meter for testing are readily understood when it is realised that no indicating instruments or stop watches are necessary, and variations in the load and voltage are automatically eliminated. The meter is designed to combine a number of capacities in one case, the changes in capacity being effected by the rotation of a drum controller of special construction, operated by means of a dial switch mounted on the cover as shown. The range in capacity covers practically all the standard capacities now in general use, namely, 1-5-10-25-50-100 amperes. The larger currents are carried by multiple-leaf brushes bearing with considerable pressure on two sides of a flat disk. For the lower capacities the usual leaf brush is utilised. The entire drum mechanism is extremely simple, and the arrangement of moving parts such that they may be easily inspected. The standard meter is arranged for 110 and 220-volt operation, the changes from one voltage to another being accomplished by means of a rotating switch. When additional voltage ranges are required, "multipliers" are used. The register is of the three-pointer type. The large circle represents a single revolution of the disk, and is divided into hundredths. The two smaller pointers make one revolution for each 10

Fig. 1.—A Watt-hour Meter Tester.

Fig. 2.—The B.S.T. Hand Lamp.

and 100 revolutions of the disk respectively. A resetting device is provided, consisting of a small button on the top of the case and so arranged that upon applying a slight pressure the hands are immediately returned to zero, eliminating the necessity of taking the differences between successive readings in order to obtain the number of revolutions for a given test. A simple sealing device is provided which will enable testing laboratories to seal the meter against any possible tampering by unauthorised persons. All moving parts, including the vertical staffs of the register, operate in jewel bearings. The main spindle is held in position by a ring jewel where it passes up through the train plate, thus insuring against possible wear.—*Electrical News* (Toronto).

The "B.S.T." Hand Lamp.

We have received a sample of a new type of hand lamp from the B.S.T. Electric Fittings Co., Dixons Green, Dudley. This has a movable handle which enables the lamp to be tilted to any angle when it is suspended by the hook seen in the illustration (fig. 2). The lamp-holder is contained in a wooden cone, in which is an ebonite plug for the entry of the wires. The wire guard is fastened by wing nuts to a flange retained by screws fixed in the wood cone. All the "live" parts are well protected, and the lamp complies with H.O. regulations in every respect.

A Combined Kettle and Teapot.

An effective time and trouble saving device has been put on the market recently by the Hastie Electric Water Heater Co., Ashley Street, Nottingham. This is an appliance which combines the functions of a kettle with those of a teapot. As will be seen from the illustration (fig. 3), the water is boiled in one compartment by means of an immersion heater. A screwed filling cap is fitted, and this has a safety valve in the centre. When the safety valve acts, the button upon the top of the kettle is pressed, and

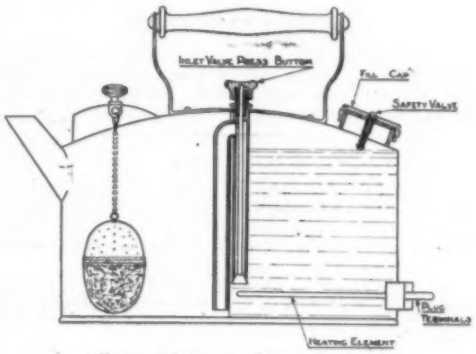


Fig. 3.—The "Hastie" Electric Tea Kettle.

the boiling water is forced by the steam pressure through an inlet valve into the other chamber. In the latter a tea-infuser is suspended. It will be seen that this device ensures that the tea is made with boiling water only, and when once made the tea is kept at a high temperature by the steam generated in the next compartment.

B.T.H. Floodlight Projectors.

Near the entrance to the Shipbuilding and Engineering Exhibition, at Olympia, is a large "Mazda" lamp poster, which is as visible by night as by day. The illumination

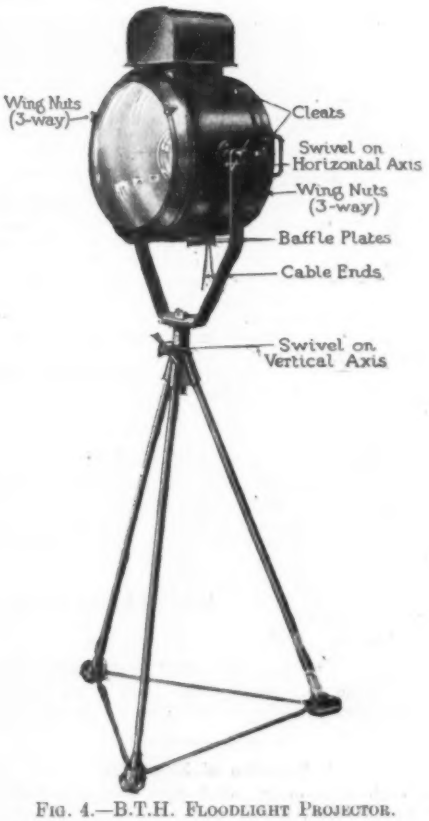


Fig. 4.—B.T.H. Floodlight Projector.

is effected by means of five B.T.H. flood-light projectors similar to that described below.

This type of projector consists of a sheet-steel cylinder with a glass front secured by wing nuts on the top of which is a housing containing a lamp-holder. The reflector may be one of three types, a plain mirror, a diffusing mirror, or a vitreous enamelled reflector. The lamp may be of from 300 to 1,000 watts capacity, gasfilled. The whole can be mounted on a tripod as shown in fig. 4, or on a segmental bracket. This illustration is about 1/13th actual size. Other types are manufactured, one of these having a conical, cast aluminium projector, the reflecting surface being the interior of the case. Coloured slides can be supplied for use with these projectors.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Novel Sign.

With regard to "E.H.K.P.'s" inquiry as to a novel sign he noticed, also your footnote, when in Paris recently the writer noticed a number of signs of this description, manufactured and installed by Messrs. Paz et Silva, of most attractive design.

The system of working is apparently as you describe. The lettering was done in script form, and a continuous length of tubing was employed, the portions not required being painted a very dark colour.

So far as memory serves, the tubing was backed by half-oval opal or sheet. The effect is certainly artistic, and one may believe that there may be a market for such signs in this country, though they are rather expensive.

Marshall Tate.

London.
September 12th, 1921.

[As noted in our last issue, the neon letter lamps are on view at the Shipping Exhibition. These lamps *contain* the letters; those to which our correspondent refers, and which we also mentioned, are shaped to form the letters.—Eds. Elec. Rev.]

Books on Lighting and Heating.

I shall feel obliged if you, or one of your readers, will be kind enough to recommend to me a manual on modern domestic and hotel lighting and heating.

Wireman.

[Possibly "The Theory and Practice of Heating and Ventilation," by A. H. Barker (Constable & Co.); "Modern Illuminants and Illuminating Engineering," by L. Gaster and J. S. Dow (Pitman & Sons); "Electric Light Fitting," by S. C. Batstone (Pitman); and "Elements of Illuminating Engineering," by A. P. Trotter (Pitman) would be found useful.—Eds. Elec. Rev.]

Abnormal Meter Readings.

With reference to Mr. Theo. R. Kernick's solution *re* the above, published in your issue of July 29th, I beg to state that the meters in question were checked by four members of our staff, including myself, at once, on receiving complaints from the consumers, and there was no error in the readings. The meters read in some cases to 1/100th of a unit and in others to 1/10th of a unit.

We use nothing but Ferranti meters, and have always found them satisfactory.

R. Forrest Preston.

Electricity Works, Ahmedabad.
August 22nd, 1921.

The Cost of Living in West Africa.

I should be very much obliged if you could obtain for me through your valued journal, the cost and conditions of living in Accra, West Africa, and whether it is at all a possible place for a white woman to live in, for the usual periods of West Africa.

R. N. Torpy.
Borough Electrical Engineer.

Tunbridge Wells.
September 15th, 1921.

[In our issue of January 14th, 1921, p. 42, some particulars of the conditions obtaining on the Gold Coast were given. We should welcome further information from our readers.—Eds. Elec. Rev.]

A Question of Sincerity.

I note with very great satisfaction that you really mean that *all* should work, and I gladly withdraw my strictures, but I am surprised to find that you have such revolutionary ideas. They are far more revolutionary than mine, and if carried into effect would completely upset the present system which divides the people, broadly, into two groups, parasites and workers, though there are plenty of parasitic workers or working parasites.

Now for the test, if I may be excused for putting it that way.

What do you suggest should be done to eliminate the parasite? It must be clear to everyone that a start in that direction will have to be made soon, or things will begin to happen. Of course, we don't want any Bolshevism in this country, yet, seeing that before the war there were upwards of two million sheer parasites in this country, and that by now the number must have increased enormously, it would be interesting to me, and I am sure, to all your readers, if you would put forward some suggestions as to how it could be ensured that *all* should work. Such a state of affairs cannot possibly come about accidentally. Deliberate attempts must be made to change the system, if catastrophic change is to be avoided.

F. W. Shorrocks.

London.
September 14th, 1921.

[Our correspondent asks us how to constitute an ideal State; we do not know—we wish we did. No man capable of working should be idle from choice.—Eds. Elec. Rev.]

The Design of Bakery Machines.

As one of the 20-odd firms which exhibited machinery at the recent Bakers', Confectioners', and Allied Traders' Exhibition and Market, we are very interested in your Editorial comments. At the same time, we must admit that your suggestion to incorporate the motor as a component part of the machine has been thoroughly studied by ourselves, but discarded as unpractical from a production point of view.

No attempt at standardising can be successful, particularly when building machines for home requirements as well as for export, whilst so many freak voltages and periodicities abound. Further, we have to consider districts where no electric supply is available.

For the above reasons our dough mixing and kneading machines are exclusively designed for belt drive. The belt risk is negligible, as the belt is behind the machine and well away from the operator. We can easily place the motor in a position to suit local conditions, that is, on the floor alongside, on wall brackets above the machine, or in the loft overhead. If existing shafting is available we can drive off it, and where neither of the above facilities exists we install an oil or gas engine.

Our experience is that belt-driven machines are the safest, inasmuch as when a seizure occurs through lack of attention or a sack of flour is inadvertently dropped into the machine, nothing more serious than the throwing-off of the belt occurs, whereas with a direct-geared machine the windings may give out. It may be said that the fuses will prevent such happenings, but in the bakehouse we do not find skilled electricians, and consequently the gauge of wire used to replace a blown fuse is of no account. We have found No. 18 copper wire used to protect a 3-b.h.p., 480-V motor!

In conclusion, we reaffirm that no attempt at incorporating the motor as a component part of the machine (always considering the universal distribution of the article) can be successful until electricity supply is standardised. Single-phase supply with freak frequencies and 330-V d.c. supply are pests.

W. Ellerd-Styles, M.I.E.E.,
Managing Director,
Artofex Engineering Works, Ltd.

London,
September 19th, 1921.

Accumulator Froth.

The correspondence in your paper concerning the above should not be allowed to drop until the definite cause has been located and the cure discovered.

The makers themselves do not appear to have realised the seriousness of the trouble, or, if they have, they have not taken reasonable care to deal with the situation.

As an illustration, the writer has had three separate 6-volt sets of accumulators by different makers, in celluloid cases, brand new, charged under his own supervision with the best materials obtainable, and has had to abandon them in favour of glass-boxed cells, owing to the destructive effects of the frothing.

When I add that the last set—a type of accumulator manufactured in very large quantities for the Government—frothed to such an extent when charged at less than one-third rate, that before the cells were properly charged the acid covering the upper half of the plates was entirely frothed out of the containers, the seriousness of the trouble may be realised. The only remedy the makers suggested was that these cells should be washed out with distilled water and re-loaded.

This suggestion, in itself, indicates that the situation has not been properly grappled with by the makers, for no kind of washing either with distilled water or the best of accumulator acids obtainable is sufficient to effect a cure.

I would not have troubled you with this correspondence, but for the fact that I am convinced the makers are not taking a reasonably scientific attitude in the matter, for if

it is desired to retain the admitted advantages of celluloid for a containing cell, it does not seem unreasonable to expect the makers to retain these advantages, whilst eliminating the possibility of frothing, by painting the interior faces of the celluloid with some such preparation as paraffin wax.

The writer's experience with three different reputed makes of cells, is such that he is completely in accord with Mr. Frost's letter; and the further correspondence of Mr. Peto, and the general attitude of the makers towards this question, lead him to assume that the makers are in sympathy with the proverbial ostrich whose head is buried in the sand.

Thos. Hesketh,
Managing Engineer.

Electricity Supply,
Folkestone,
September 19th, 1921.

Organ Blowers.

Commenting on "Organ Blower's" letter, which appears in your issue of September 16th, 1921, there are in general two types of blower, *i.e.*, motor-driven fans and motor-driven feeders; the latter, usually three in number, are operated by a three-throw crankshaft on the under-side of the bellows. To the best of my knowledge the latter scheme can only be applied where a d.c. supply is available, as obviously the speed of the motor has to be controlled in accordance with the demand for wind.

"Organ Blower" states that a d.c. motor is easily controlled by means of resistance in the armature circuit, but this method is extremely wasteful of power and should only be resorted to if the only practicable scheme is a three-throw feeder.

I hold an appointment as organist, and am responsible for a three-manual organ, the wind supply for which is furnished by a motor-driven fan. The motor is a 3-h.p., 3-phase squirrel cage machine, and is started up by means of a Y-delta switch. The speed is more or less constant; the control of the wind supply being entirely automatic. This is effected by inserting between the main bellows and the fan a control box, inside of which is a wooden grating. On the blower side of the grating a leather roller blind is fixed, spring biased to the down (air inlet to bellows closed) position. When the bellows are empty, however, a cord fastened to the top of the bellows, and passing over suitable pulleys, pulls up the roller blind, thereby fully opening the inlet to the bellows. When the fan has attained full speed the bellows begin to rise and at the same time the roller blind commences to descend (gradually closing the fan outlet).

The operation of this gear is extremely satisfactory; the wind supply is steady, and there is no elaborate electrical control gear to contend with.

I agree that there is certainly an objectionable hum with a.c. motors, an inherent feature which in this instance we overcame by building a sort of double box with felt packing. This box is large and fits over the whole of the blower equipment. The air is drawn through gratings in the wall at the motor end, and suitable inspection doors are fitted in the box. By so placing the inlet gratings, all the air passes across the motor, thereby ensuring very little increase in temperature rise, due to the boxing-in of the equipment. It should be noted, however, that this sound-proof box is of generous proportions, otherwise trouble might have occurred due to the excessive temperature rise of the machine.

An important fact with regard to fan blowers is that when the outlet is closed the fan is running, comparatively speaking, light, and there is therefore no waste of power.

In conclusion, I would point out that an organ blowing equipment should not be bolted to the floor, as if this is done the motor will be heard all over the building. The bedplate of my equipment rests on felt pads and is not bolted down at all, yet I have not experienced any tendency for it to "walk."

C. H. C.

September 19th, 1921.

With regard to "Organ Blower's" letter in your issue dated September 16th, 1921, the writer is evidently not conversant with the latest practice. We make an a.c. motor practically silent, running at 1,600 r.p.m., which in turn operates a device giving 5 r.p.m., and this device also is practically silent. We shall be pleased to show him the arrangement at work if he cares to write us.

We might point out that the method he mentions of inserting resistance in the armature circuit of a d.c. motor is a very inefficient way to reduce the speed.

H. A. Easter.
For British Electric Co.

London,
September 17th, 1921.

We are interested in the letter appearing in your issue for September 16th, regarding the difficulty of changing-over electric organ-blowing installations from direct-current to alternating-current working. We have carried out many hundreds of electric organ-blowing installations of various types, and our experience is that the rotary blower is the only practicable plant to install for alternating-current working, the blower running at constant speed and the regulation being carried out by means of a wind control valve attached to the organ reservoir.

With a specially designed blower the wind will merely circulate in the casing when the delivery is closed by the regulating valve, and the current taken by the motor will fall under these conditions.

It is usually possible to find a place for these blowers, either in an adjoining vestry, or in a chamber below the organ, although sometimes it is necessary to sink a pit or build an outhouse outside the church.

The output of a rotary blower is quite independent of the bellows capacity of the organ, and any quantity of wind can be arranged for at a steady pressure.

It is, of course possible to operate a feeder blowing installation with alternating-current motors, regulating the speed of blowing by means of fast and loose pulleys and automatic striking gear controlled from the reservoir, or, alternatively, a repulsion type motor can be used on single-phase circuits with resistance control. All these arrangements are, however, inclined to be noisy, and cannot compare with the direct-current installation for smoothness in working.

For these reasons we ourselves have made it a practice to adopt a rotary blower direct coupled to motors for all alternating-current work, and we shall be very pleased to give your correspondents any further information on the subject if desired.

The Rockingham Engineering Co.

Thornton Heath,
September 19th, 1921.

Carpets and the Electric Suction Cleaner.

Re correspondence in the Review on this subject. I presume this deals with domestic machines and not with plant for commercial work.

I have had 40 years' experience in cleaning carpets, and have yet to see the vacuum or suction cleaner that can do so efficiently. For loose fabrics or surface cleaning, or tidying up, I admit that the vacuum has its use, but I maintain that to remove the dust from the body and not merely from the surface of a Brussels or Axminster carpet the only practical and efficient method is to beat it. Should any of your readers wish for further proof of this I shall be happy to give details.

Alex. Orr.

Edinburgh,
September 19th, 1921.

Supply without Statutory Powers.

The letter regarding the above makes very interesting reading. In my mind, "A.O.G." is getting rather alarmed at the prospect of an outside supply. It seems they have had the field pretty much to themselves. I wonder what is the difference in cost per kWh, between the supply under discussion, and the proposed figure (3d. per kWh)? If the figures are much higher, why? I think it is the dearness of supply (not always justified) that has hindered the progress of village lighting and power. Why all this bitter feeling on the part of the R.D.C.? It must have a reason. I think the sooner "the far-distant electric station" erects its transmission lines, the better for those in need of cheaper electricity.

Northwalian.

September 19th, 1921.

In your footnote to my letter last week you say I "question whether an outside supply at 2½d. or 3d. per kWh can compete with a private installation," although I have elsewhere assumed the opposite.

At the risk of appearing to be trying to run a serial in your columns, may I point out that two kinds of private installation, with vital differences, were mentioned?

The approximate figures of the village supply are:—Population 800, annual output 8,000 units, all lighting, no power load. This case is best dealt with, keeping in mind the lowest possible total of annual charges on capital and cost of labour, by installing a 14-h.p. engine, running somewhere near full load, four hours per day on an average, in conjunction with a storage battery. The fuel cost per unit, delivered to consumer, with an oil engine of the type mentioned, would be about 2d. But, and here comes the rub, you must have a man in charge, and, however easy his work, he must have a decent rate of pay. His wages in this case at only £2 12s. a week say, come out at 4d. per unit.

If the population does not exist, to require a larger plant, you cannot reduce this item, and that is exactly where these very small schemes differ vitally and inevitably from the larger ones.

There are still the capital charges &c., but as we already have 6d. against the 2½d. or 3d. before assumed, we need go no further. It is taken that the outside supply would be by static transformer.

It is unnecessary to labour the point that the case of the other private installation, a works power supply, is not comparable with the above, and that a supply at 3d. which would

undersell the first, might possibly not be cheap enough for the second.

Regarding the attitude of some of the labour men, which you describe as a mystery, the only explanation is hatred of private ownership of public utilities carried to fanatical extremes.

Thanking you for the use of your valuable space.

A. O. G.

September 19th, 1921.

[We are much obliged for this interesting statement, which fully explains the situation.—Eds. Elec. Rev.]

A Conundrum.

Shortly after the appearance of an article in your issue of July 29th entitled "Super-scale Measuring Instruments," we received the following inquiry:—

"*Re* article in the Review.

"If four super-scale instruments are arranged in a Scott Bow, how many herrings can one purchase for a shilling?"

As you are possibly aware, we rather pride ourselves upon our ability to deal with any and every problem that may arise in connection with electrical measuring instruments, but our pride has had a fall, and we must confess that this one completely baffles us.

It seems clear that the "herring" is introduced as a term of contempt, and symbolises the now almost obsolete 90 deg. scale ammeters and voltmeters which our correspondent evidently values at several to the shilling.

What defeats us, however, is the reference to the "Scott Bow." We have consulted every available dictionary as well as several members of the B.E.S.A. Committee on Nomenclature, but in vain: and yet on referring to the article in question we find on page 139 that the term is used without any comment whatever. It occurs to us, therefore, to ask whether you or any of your readers can help us?

Everett, Edgcumbe & Co., Ltd.

London,
September 19th, 1921.

[On reference to the article we were as much perplexed as our correspondents to account for the mysterious allusion. On investigation, however, we find that it resulted from a hieroglyph of the author's which was intended to read "switchboard."—Eds. Elec. Rev.]

The Testing of Meters.

I have read with great interest Mr. R. M. Moberly's article on the testing of meters in your issue of September 9th. I would, however, like to draw your attention to the Sangamo portable test meter, since in Mr. Moberly's article he only mentions a meter supplied by the British Thomson-Houston Co., or the Metropolitan-Vickers Co.

In some respects the Sangamo meter is an improvement on the others mentioned, since the standard current ranges of the Sangamo meter are 1, 5, 10, 25, 50 and 100 in the self-contained meter, which is, I believe, considerably more than is possible on the other meters specified.

E. H. Miller,
For the Edison Swan Electric Co., Ltd.

Ponders End,
September 19th, 1921.

[By a coincidence, this portable meter is described in our "New Devices" to-day.—Eds. Elec. Rev.]

Situations Vacant.

A vast amount of time, trouble, and disappointment would be saved if the employers advertising vacancies in your columns would state for what part of the country they are offered—London, Glasgow, &c., or even Midlands, North of England, &c.

This week most of the notices do contain the information, but there are still five which do not, and it frequently happens that jobs are offered the nature of which must obviously appeal to many without the slightest indication as to what part of Great Britain the post lies.

Watts.

September 17th, 1921.

Enamel for Mercury Meter Disks.

In your issue of September 9th there was an interesting article on "The Testing of Electricity Meters." The author mentioned the necessity of burning off the mercury and re-insulating the disk of Chamberlain and Hookham meters, but did not name an enamel that would be suitable for the job.

I should be very pleased if you or any of your readers could give me information as to a suitable enamel and whence it could be obtained.

F. B. S.

"F. B. S." is advised to consult Messrs. Chamberlain and Hookham, who no doubt will let him know the name of their present varnish or supply him with some. Failing this, a sealing-wax compound has been found satisfactory for several years.

R. M. Moberly.

Wind Power Machinery.

I shall be very glad to receive communications from any firms manufacturing modern types of windmill suitable for pumping or driving electric generators.

J. W. Beauchamp,
Director and Secretary, E.D.A.

84, Kingsway, London, W.C. 2.
September 20th, 1921.

Sane Methods of Providing Employment.

The leading article of March 18th, commenting upon the attitude of supply authorities and new service connections, evades what, in many instances, is the crucial point. You apparently make no allowance for the stringent financial conditions under which many of the smaller electricity undertakings are struggling, and where, owing to inadequate working capital, enterprise has perforce to be strictly curtailed.

It seems to me regrettable that some of the funds now being expended to meet the prevailing problems arising from unemployment, cannot be utilised for useful industrial purposes. The existing method of dealing with the matter represents a real loss to the community. If financial aid could be given to those public utility companies which are not only endeavouring, despite the present difficulties, to carry out their statutory obligations, but also desire to embark upon urgently necessary extension schemes, the capital so advanced would ultimately be wholly repaid and work provided for both technical men and skilled artisans—a class who obviously gain no encouragement from the announcement of road-making projects.

Some such suggestion carried into effect would result in permanent employment for various branches of engineering and add its quota to the industrial development of the country.

H. H. Arthur, M.I.E.E., M.I.Mech.E.

Electricity Works, Staines.
September 15th, 1921.

[Our reference of March 18th was to illegal charges, and methods likely to hinder the progress of electricity supply; on April 29th and May 27th, we drew attention to the hard case of the small supply companies, and we venture to suggest that our correspondent's criticism is somewhat belated. The proposal which he puts forward is one with which we are in full agreement, and we are pleased to note that in principle it has received the support of Sir Alfred Mond's Committee, and other authorities on the industrial situation.—Eds. Elec Rev.]

[Will "Not a Prude," who has written us a letter for "Correspondence" columns relating to an advertisement appearing in our last issue, kindly send us her name and address, in accordance with our rule?—Eds. Elec. Rev.]

REVIEWS.

The Elements of Direct-current Electrical Engineering. By H. F. Trewman, M.A., and G. E. Condliffe, B.Sc. Pp. 219; 146 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

The authors of this book have set out to bridge the gap existing between the elementary text-books on magnetism and electricity and the more advanced books which deal with the design point of view. The result is a very concise outline of the elements of d.c. electrical engineering, which should prove particularly useful to engineering students who are already familiar with the simple phenomena of electromagnetism, and who are passing through electrical shops and test bays.

The book is divided into twelve chapters, the first of which deals with units and gives a *résumé* of the fundamental laws of electromagnetism. Then follow two chapters on induced currents and electromagnetism, in the latter of which the subjects of magnetic testing and the magnetic circuit are dealt with very fully. A few examples at the end of each chapter serve to crystallise out the most important points and to ensure that the student can make calculations—a good test of the soundness of his knowledge.

In the chapter on instruments the authors, while dealing only with typical cases for the sake of simplification, have succeeded in covering a very fair amount of the ground, including ammeters, voltmeters, dynamometers, wattmeters, recording instruments, potentiometers, and the various types of supply meters. The only notable omissions are hot-wire instruments and the electrostatic voltmeter. A wire preference for line diagrams over the customary catalogue illustrations characterises this section of the book. It is a pity that a little more space has not been given to the Edison cell in the chapter on storage batteries, but, so far as the lead cell is concerned, the treatment is both clear and comprehensive.

In the five chapters dealing with the dynamo, which naturally occupy nearly half of this little volume, the construction and parts of the dynamo are first explained; then the various types of windings are described and the method of calculating the e.m.f. of the machine is given. The methods of excitation

are next described, followed by a number of typical calculations on the magnetic circuit for a d.c. machine. Commutation and armature reaction form the subject of a separate chapter, as do also losses which are analysed very carefully, the treatment forming a useful introduction to the subject of testing to which the last chapter is devoted. The operation characteristics associated with the various types of excitation are covered very fully in a further chapter, the whole treatment of the dynamo being exceptionally thorough and practical.

The Arithmetic of Telegraphy and Telephony. By T. E. HERBERT and R. G. DE WARDT. Pp. viii+187; 38 figs. London: Sir I. Pitman & Sons, Ltd. Price 5s. net.

Ability to make accurate calculations in any branch of applied science demands not only experience and accuracy in using the ordinary operations of arithmetic, but also a definite understanding of the technical principles involved. Many students and qualified technical workers lack one or other of these essentials, and sometimes they come to grief on both counts. The present volume is, therefore, sure to be welcomed by a wide circle of students and workers in the field of telegraphy and telephony, for it provides at once an admirably clear exposition of arithmetical methods and a first-class means of testing and consolidating technical knowledge by the working of numerical examples. Those who go straight from school to college or evening classes cannot realise the *hiatus* created by even a year or two between schooldays and the endeavour to apply the lessons then learnt more or less efficiently.

The first chapter, dealing with all the ordinary rules and operations of arithmetic, is therefore far from unnecessary. Then follow chapters dealing with the calculations appertaining to the arrangement of cells; shunts and current division therein; resistance of conductors; measurement of current, e.m.f., and resistance, and fault localising. In each case the general method of treatment is as follows: The theory of the subject is discussed briefly in so far as it affects quantitative calculations, and worked numerical examples are then given illustrating the solution of problems for all the conditions likely to be encountered in practice. Finally, a number of set problems are presented, answers being given at the end of the volume.

In addition to the chapters mentioned above there are others dealing with the calculations appertaining to condensers, to magnetic circuits and electromagnets; to work, power, and heating; to electrolysis, and to overhead lines. The final chapter on curves gives an excellent introduction to the plotting and interpretation of graphs. Simple arithmetical methods are employed throughout, and the authors deserve the thanks of their readers for the care devoted to selection and presentation of the subject matter. The volume has a distinct value as a technical handbook, quite apart from its arithmetical function. It can be used as well for private study as for class work, and it will be particularly appreciated by post office employés and by candidates for the Grade I examination in telegraphy and telephony. Needless to say, the calculations involved in most of the subjects enumerated above are equally applicable in other branches of electrotechnics, so that the book has a much wider field of utility than is covered by its title.

There is a chapter on the d.c. motor which, while it only occupies 20 pages, succeeds in covering all the essentials, and includes a fair account of starters and control gear. The few examples at the end of the chapter have been carefully chosen, with a view to emphasising the essential points, and are of a practical character.

The few criticisms we would make concern matters of detail, the general planning and execution of the work being sound and praiseworthy. The statement of the practical units in Chapter I is not ideal; in view of the scope of the book the B.O.T. or International Units would have formed a more suitable basis than the G.G.S. electromagnetic system. The "amount of the inertia" referred to on page 157 should read "moment of inertia." Apart from such minor matters, we think well of this little book, and would recommend it to students as a good common-sense account of direct-current electrical engineering.—P.H.S.K.

Is Trade Unionism Sound? A suggestion for outflanking the power of capital. By J. H. BUNTING. Pp. x+98. London: Benn Brothers, Ltd., 1921. Price 6s. net.

In a note by the publishers, enclosed with the book, we are informed that it was printed and privately circulated during the war by the Garton Foundation. It is well that this fact should be appreciated at the outset, for reasons which will appear later. Further, it is explained in a footnote that the expression "the power of capital" does not mean its beneficient power in the promotion of production, but the tyrannical power that it may become in hands that use it ill.

The author has devoted a considerable amount of thought to the preparation of his arguments, and has shown that there is much to be said in their favour. They are carefully set out and well arranged. They amount, in substance, to a suggestion that collective bargaining is not the best method of advancing the interests of the workers. Their interests, and with them those of the whole community, would be better served by the prompt acceptance by the workers of the terms offered by employers. To make the greatest possible use of capital, i.e., of labour-saving machinery and the like, they are to take the highest wage they can readily obtain, and, by an immense increase in production, reduce the relative amount they pay for the use of capital. In other words, as we have never ceased to point out, the overhead or standing charges are to be spread over an enormous output, and so become smaller not only absolutely, per article produced, but relatively, when compared with the total sum paid to the workers as wages.

Safeguards are suggested, so that the rates of wages obtaining in different parts of the country are known to all the workers, and employers who do not pay well do not get any workers. The demand for workers is so increased by the cheapening of the supply of labour, that competition between employers ensues. The increased production of goods cheapens everything and so increases the effective demand. This brings about a boom, plenty, and prosperity for all.

We should like to see a greater "will to work" on the part of the whole community. The gospel of work needs preaching to-day more than any other. If it could be universally realised that the good of all depends upon the effort of each one of us, and the good of each depends upon the effort of all, the world would be a lot happier than it is to-day. Abolish selfishness and substitute goodwill, and you are well on the way towards peace on earth, with all that that implies.

Yet we are compelled to ask if there is the least possibility that the wisdom of this course will be accepted by the workers. At present we fear the answer must be an emphatic negative. The workers know something of the history of their lot, and they cannot find that it was better before collective bargaining was first instituted. On the contrary, it was infinitely worse. At the stage that had been reached in the early days of trade unionism, united action was an imperative necessity, and we have often shown how the employers' action in cutting piece-rates, and in seeking generally to impose a limit on the possible earnings of their employés, staff and manual workers alike, discouraged these employés from putting forward their best efforts, and directly fostered the worst features of trade unionism. And now that collective bargaining has become the order of the day—and let it not be forgotten that there are employers' associations which exist for the purpose of standardising rates of pay, as well as trading combinations which control market prices—the course which has commended itself to most of those who have devoted time and thought to the problem is that of a proper regulation of collective bargaining. What else are Whitley Councils than controlled, or regulated, bodies which exist for the purpose of discussing and settling rates of pay, working conditions, and all matters relating to the industries in which they are interested?

The reader will now see why we insisted at the beginning of our consideration of Mr. Bunting's book that it was printed during the war. No doubt the Whitley reports had not then been issued, and Mr. Bunting's work was the result of his own meditations on this most important matter. He saw, as we all saw, the days when unemployment did not exist, when demand was so great and insatiable that all available labour was absorbed in satisfying it. Alas! that it was all for destructive purposes. If only we could apply to the arts of peace the concentration of purpose, the initiative, the unity of effort, that we applied to the arts of war, not only the country but the war-weary world would be the better for it.

Dealing with the book itself, we admire the way in which it is set out, the subjects treated being arranged in headed and numbered paragraphs, so that any particular point can be turned up from the contents list—there is no index—with a minimum of trouble. We rather wonder how Mr. Bunting's arguments are helped by the supposition, on p. 34, that we are in Mars, and that the conditions are precisely the same as on our own planet. We also wonder how long it has been true that it costs 25s. to produce the gold in every sovereign (p. 46). "Same" is not a relative pronoun (p. 66). We do not consider the interest analogy on p. 55 a good one. It is very seldom that compound interest accrues on capital in the shape of money, and the compound interest growths in nature are limited by other operations of nature—very fortunately, too, or the sea would be stiff with fish, and flies would cover the earth. "Has" should be "have" on p. 4, and "effected" should be "affected" in the last line of p. 51.

We hope we have shown that we have been much interested in Mr. Bunting's book. We should be further interested to learn whether he still considers that the acceptance by labour of the best terms available would be better than the widespread—in fact, universal—acceptance of what we may call Whitleyism, and how he suggests that his principles should be so brought home to the workers that they may be appreciated and acted upon.

Nitrogen Products from the Air.—Dr. William S. Nicholas, chairman of the Board of the Allied Chemical and Dye Corporation, speaking before the annual meeting of the American Chemical Society at New York, said that chemists of his company had succeeded in solving the German secret of making nitrogen products from nitrogen in the air.—*Birmingham Post.*

BUSINESS NOTES.

Bankruptcy Proceedings.—Charles Augustus Carpenter, electrical engineer, 4 and 5, Mason's Avenue, Basinghall Street, E.C.—This debtor attended at the London Bankruptcy Court on September 13th for public examination under the receiving order made against his estate on June 27th. A statement of affairs showed gross liabilities £1,560, all of which were expected to rank for dividend. The only assets disclosed consisted of shares in C. A. Carpenter, Ltd., of doubtful value. The debtor said that in October, 1913, he, in partnership with another person, commenced the business of electrical engineers at 4, Maidenhead Court, Aldersgate Street, E.C. In December, 1913, the business was sold to a private company, which, in the following year went into voluntary liquidation, and thereafter he continued a similar business on his own account at the same address. Towards the end of 1916 he was joined by a partner who put in £200 capital. In June, 1917, he (debtor) left the business, his partner retaining the assets in consideration of the capital which he had introduced. In July, 1917, he became managing director of a company formed to acquire a patent burglar and fire alarm which he had invented. As vendor he received £500 in cash and £900 in shares, but in June, 1918, he resigned his appointment and sold his shares for £150. In June, 1918, he rented premises at 4 and 5, Mason's Avenue, E.C., and recommenced business on his own account as an electrical engineer. In December, 1918, and March, 1919, he was joined by partners who, however, retired after a few months. Owing to illness and labour troubles his trading had not been successful, and in March, 1921, he registered a private company "C. A. Carpenter, Ltd.," with a capital of £2,000, to which he transferred the whole of his business assets, but the company did not take over his trade debts. As vendor he received 1,998 £1 fully-paid shares, 1,200 of which were allotted to his brother in consideration of advances received in August, 1920, which advances had been made on the understanding that shares would be allotted therefor when the company was formed. He attributed his failure to ill-health during the past two years, to labour troubles, and to lack of capital. Of the unsecured liabilities £1,044 was due for cash advanced; £410 for trade goods supplied, and work done; £56 for rent; £29 for law costs, and £15 for repairs. The examination was concluded.

M. Watkinson, H. Watkinson, and A. Watkinson (Watt & Co.), electrical and mechanical engineers, 22 and 24, Palmer Road, Sheffield.—First meeting September 23rd at Official Receiver's Offices, Sheffield. Public examination October 20th at the County Court Hall, Sheffield.

J. Jones and J. R. Jones (J. Jones & Son), electrical engineers, Penzance.—Last day for proofs for dividend October 3rd. Trustee, Mr. W. C. Pezzack, Public Buildings, Penzance.

Company Liquidations.—Maxim Lamp Works, Ltd.—Petition for winding up has been presented to the High Court by Messrs. C. Quitman, glass merchants, &c., of 3, Cloth Lane, E.C., and will be heard in London on October 18th.

City Electric Welding Co. (Newcastle), Ltd.—Winding up voluntarily. Liquidator, Mr. J. C. Graham, Junr., 16a, Granger Street, Newcastle-on-Tyne, to whom claims should be forwarded by October 14th. Meeting of creditors called for October 4th.

Florundum Flame Carbons, Ltd.—Meeting will be held October 17th at 4, Pavilion Buildings, Brighton, to hear an account of the winding up from the liquidator, Mr. F. N. Clarke.

Oxford Portable Projector, Ltd.—Winding up voluntarily. Liquidator, Mr. W. G. Barnard, Fernwood, Ashford, Middlesex.

Little Wonder Battery Co., Ltd.—Meeting of members will be held at 26, Budge Row, E.C., on October 21st to hear an account of the winding-up from the liquidator, Mr. R. G. Pye.

Dissolutions of Partnerships.—W. C. Martin & Co., 10, West Campbell Street, Glasgow.—Mr. Gilbert Austin has voluntarily retired from this partnership, and Mr. James Lowson, the other partner, has acquired the whole assets of the firm, and will discharge liabilities. He will continue to carry on the business under the same firm name.

McCullock & Newitt, electrical and general engineers, 44, Park Street, Leeds.—Messrs. H. McCullock and H. Newitt have dissolved partnership. Mr. H. McCullock will attend to debts and continue the business.

Trade Announcements.—The business of electrical contractor carried on at Victoria Street, Morecambe, by Mr. George Morrison, has been taken over by Mr. H. N. Shorrock, the manager.

Mr. Archibald Campbell, who represents the Swiss Insulating Works, Ltd., of Bretonbac, is now conducting the agency from 8, Wolseley Road, London, N. 8, instead of, as hitherto, 27, Chancery Lane, W.C. 2. His 'phone number is now "Hornsey 2601."

Catalogues and Lists.—Messrs. Melchior, Armstrong and Dessan (London), Ltd., 14 and 14a, Gt. Marlborough Street, Oxford Circus, London, W. 1.—An illustrated booklet giving full particulars of construction and operation of the "Madstrong" electric lighting plant.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—A card bearing eighteen samples of telephone cables of various types, lead-covered wire, and flexible wires.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Price List No. 6 giving specifications, prices, &c., of a.c. and d.c. motors.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—Price list No. 10,482A, giving illustrations and particulars of B.T.H. floodlight projectors for advertising purposes, &c.

The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. 2.—Leaflet O.S. 2,569, advertising "Osglim" neon lamps containing letters and numerals. Illustrated and priced. Illustrated booklet, showing component parts and method of connecting up of the "Kingsway" wiring system.

Illustrated leaflet No. X (3) section, 13th edition, showing standard types of circuit breakers, together with leaflet No. X 2,523, of revised prices of circuit breakers appearing in the former.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W. 8.—Illustrated leaflets, giving prices, &c., of automatic motor starters, starters for squirrel-cage motors, ironclad switchgear, &c.

Messrs. Carrick & Ritchie, Ltd., Edinburgh.—Illustrated booklet, giving prices, &c., of "Waverley" and "Girard" turbines, Pelton wheels, and other water motors.

Book Notices.—"Aluminium and its Alloys," by Lt.-Col. C. Grand, translated by C. M. Phillips and H. W. Phillips. Pp. xxiv+184; 83 figs; 17 plates. London: Constable & Co., Ltd. Price 17s. 6d. net.

"Practical Electricity," by W. E. Ayrton. Revised and largely rewritten by Prof. T. Mather. Pp. xxiii+547; 289 figs. Price 15s. net.

"Electricity in the Service of Man," Vol. II, Section III. "The Technology of Electricity," by R. Mullineux Walmsley. Pp. ix+738 and index. Price 15s. net. London: Cassell and Co., Ltd.

Proposed Railway Classification of Goods by Merchandise Trains.—Table showing the approximate percentage relationships between the 20 new classes proposed, and also between the existing eight classes. Chart 1. Huddersfield: Hirst and Adamson. Price 1s. 6d.

Journal of the American Institute of Electrical Engineers. Vol. XL, No. 9, September, 1921.—New York: The Institute.

"Electrical Contractors' Year Book," 1921-22.—London: Electrical Contractors' Association. Price 2s. 6d. net.

Safeguarding of Industries Act.—In accordance with Section 7 of the above Act, the president of the Board of Trade has appointed the following gentlemen to be members of the permanent panel from which committees, consisting of five persons, will be selected from time to time to consider and report upon complaints referred to them by the Board under Part II (Prevention of Dumping) of the Act:—

Sir W. M. Acworth.	Sir George R. Lowndes, K.C.S.I., K.C.
J. Arthur Aiton, C.B.E.	Prof. D. H. Macgregor.
Sir William Ashley.	Stanley Machin, J.P.
Arthur Balfour, J.P.	G. A. Moore.
Sir George S. Barnes, K.C.B., K.C.S.I.	J. W. Murray, D.L.
Sir John N. Barran, Bart.	Sir Douglas Newton, K.B.E.
J. T. Brownlie.	Owen Parker, C.B.E., J.P.
Sir Cecil L. Budd, K.B.E.	R. G. Perry, C.B.E.
Sir James C. Calder, C.B.E.	Arthur Pugh.
Dr. J. H. Clapham, C.B.E.	Sir R. Henry Rew, K.C.B.
F. P. Dorizzi.	C. A. Russell, K.C.
F. R. Davenport.	Arthur Shaw.
A. K. Davies.	Sir Charles Stewart, K.B.E.
T. P. Cook.	Sir Edwin F. Stockton, J.P.
Rayner Goddard.	H. L. Symonds.
Sir E. C. K. Gonner, K.B.E.	Gilbert C. Vyle.
	Sir Frank Warner, K.B.E.

Lists of Articles Chargeable with Duty under the New Act.

There have been issued under the Safeguarding of Industries Act, 1921, lists of articles chargeable with duty under Part I of the Act. Copies are obtainable from H.M. Stationery Office at 9d. net. Under Section I of the Act, it will be remembered, it is provided that for the purpose of preventing disputes arising as to whether any goods are or are not chargeable with duty, the Board may issue lists defining the articles which are to be taken as falling under any of the general descriptions set out in the Schedule to the Act. The pamphlet contains lists defining numerous articles falling under many descriptions, such as optical glass and instruments, optical instruments, laboratory porcelain, scientific instruments, gauges and measuring instruments, compounds, synthetic organic chemicals, lamp blown ware; wireless valves and similar rectifiers and vacuum tubes; ignition magnetos and permanent magnets; arc lamp carbons; metallic tungsten, &c.

Glasgow Shipbuilding, Engineering and Electrical Exhibition.—Glasgow Corporation has decided not to hold the above exhibition this year.

For Sale.—By direction of the Disposal Board, Messrs. Oliver Appleton & Kitchen will sell by auction on September 27th and following days at Barnbow, near Leeds, machine tools, engines, boilers, electric motors, electrical equipment, &c.

By order of the Receiver, Messrs. L. Farmer & Sons will sell by auction at an early date on the premises of Oylers Ltd., Station Works, Richmond, plant and machinery of a rubber tire manufacturer.

Messrs. B. S. Baldwin & Son will sell by auction on September 30th, at the Strafford Arms Hotel, Wakefield, power plant consisting of a 400-kW Turbo-Alternator Set, coupled to a h.p. turbine, condenser, pump, switchboard, &c.

For full particulars see our advertisement pages to-day.

Inquiry.—Information is desired regarding the "Kaplan" water turbine, mentioned in our issue of April 9th, 1920.

Bulgarian Economic Commission.—The Parliamentary group of the Agriculturists' party has elected an economic commission for the purpose of examining certain questions of great importance to the country. Among the questions to be considered by the Commission are the electrification of the railways and the manufacture of briquettes from Pernik coal. —*Reuter's Trade Service* (Sofia).

Fusion of Swedish Electrical Companies.—"Svenska Dagbladet" learns that an ordinary meeting of Aare Aktiebolag has decided upon fusion with an electric power company now being formed under the style of Vaestra Jaemtlands Kraftektiebolag for the purpose of distributing electric power throughout West Jaemtland.—*Reuters' Trade Service* (Stockholm).

Engineering Amalgamation.—According to the "Financier," a scheme is on foot for the amalgamation of Fairbairn Lawson Combe Barbour, of Leeds, with Urquhart, Lindsay and Co., and Robertson & Orchar, Dundee.

Cardiff Invites Manufacturers.—The Development Committee of the Cardiff City Council has issued a booklet containing information regarding the suitability of the city for the establishment of works, factories, &c. The matter relates to such matters as labour, water supply, power and light facilities, existing industries, land available, &c. A number of appropriate half-tone photographic views appear, and there is a large map showing sites that are offered. Copies of the booklet can be obtained from the Development Agent, City Hall, Cardiff.

Australian Zinc Concentrates.—The Electrolytic Zinc Co. of Australasia has completed a contract with the British Board of Trade for the sale of 750,000 tons of concentrates and slimes.—*Reuter* (Melbourne).

Electrical Supplies in South Africa.—The "South African Mining and Engineering Journal" (Johannesburg), of August 27th, states as follows: "The tone in electrical goods is better and trade seems more buoyant, but business still continues very quiet. As soon as the trouble in the building trade is out of the way there are good grounds for anticipating a big revival of business. Although there are no reductions of importance to report, the tendency is for prices generally to come down, and some alterations may be expected next month. There have recently been some declines on account of forced sales, but generally prices remain much about the same. Consignments from Britain are arriving steadily, with, however, no reductions, although these are expected to occur in the near future. Shipments from Germany are slower, but still dribbling in, at prices a long way below British. Electrical wares are also arriving now from America fairly freely, showing slight reductions in comparison with British quotations."

Receiver Appointed.—H. W. Smith & Co. (1920), Ltd.—Mr. J. H. Stephens, of 6, Clements Lane, E.C., was appointed receiver and manager on August 30th, under powers contained in debentures dated February 11th, 1921.

Unemployment in Germany.—According to the *Economic Review*, the number of persons in receipt of unemployment relief in Germany has steadily declined since April. On the first day of that month the total was 413,421, while on August 1st, it had fallen to 269,424.

Patent Restoration.—An order has been made for the restoration of patent No. 11,116 of 1914, and the patent of addition No. 3,433 of 1915, for "Improvements in or relating to electrical reactance cells" and "Improvements on reactance cells," granted to Philip Torchio.

Braby's Extensions.—Messrs. Fredk. Braby & Co., Ltd., of Petershill Road, Glasgow, in preparation for world trade improvement have just completed several large extensions to their works, facilitating increased production of their specialities. The extensions include an addition to the engineering shop, a new bay to the heavy tank shop, a new steel bin and furniture department, a new roof light &c., department. The engineering shop is equipped with a complete range of modern machine tools. The firm has issued a handbook (160 odd pages), of its manufactures, for the use of architects and engineers, and copies will be sent on application.

Lantern Slides.—Mr. George Ellison, of Perry Barr, Birmingham, is prepared to lend a comprehensive set of lantern slides illustrating his various types of electric control gear, and of the works where these are made, to engineering and technical societies, and technical colleges, if they will intimate their desire to have them on loan.

Linen Mill Electrification.—It is satisfactory to know that many Irish concerns are now taking advantage of the slackness in manufacturing to bring their mills and factories thoroughly up-to-date. Thus, in keeping with their traditional progressive policy, the directors of Wolfhill Spinning Co., Ltd., Belfast, are having their present system of steam-driven machinery superseded by a complete electrification of the mill. The new plant will include a Rateau impulse-type turbine direct-coupled to 3-phase, 50-period, 3,000-r.p.m. alternator, with direct-coupled exciter having radial type commutator. The set is designed to give a normal full load of 1,000 kW, and to pass 6,000 to 10,000 lb. of steam at a pressure of 20 lb. per sq. in. gauge to the heating system. In fact, this means double the power of the present beam steam engine, while only one-twentieth of its space is occupied. —*Textile Recorder.*

Reported Find of Copper, Coal and Iron in Ireland.—It is reported from Mountmary, Mountbellew, that a copper, coal and iron mine has just been discovered, or re-discovered, in the locality known as the "Coal-pits." Local people have taken the matter up with a view to asking the Irish Industrial Research Committee to inquire into it.

New Steel Works in Japan.—The Nitto Steel Works has equipped its Kawasaki Works for the manufacture of electro iron plates, and three German experts have been engaged. —*Reuter's Trade Service* (Tokio).

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions associated with the electrical trades and industries:—

Suncolite. No. 416,647. Class 8. Electrical fittings and accessories.—Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C. July 4th, 1921.

Titan. No. 406,444. Class 13. Sparking plugs.—Champion Ignition Co., Harriet Street, Flint., Mich., U.S.A. July 26th, 1921.

O.A. (lettering and design). No. 414,252. Class 13. Electric incandescent lamps (ordinary), parts, fittings, &c.—Osram Gesellschaft, 11-14, Ehrenberg Strasse, Berlin, 017. April 12th, 1921.

Dasola. No. 416,786. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Dosala. No. 416,787. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Durosala. No. 416,788. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Durasola. No. 416,789. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Dursoa. No. 416,790. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Majestic. No. 416,844. Class 13. Electric irons and electric water heaters.—Majestic Electric Development Co., 656, Howard Street, San Francisco, U.S.A. July 11th, 1921.

Triangle and Circle design. No. 415,075. Class 13. Electrical metal goods.—Delta-Star Electric Co., 2433, Fulton Street, Chicago, U.S.A. May 10th, 1921.

Underground Telephone Cables.—The telephone cable company, which was formed some time ago under the leading of the German Ministry of Posts and Telegraphs for the starting and acceleration of the construction of underground telephone cables on a uniform basis for long-distance transmission and which was limited to the A.E.G., Felten & Guilleaume Co. and the Siemens group, has now been extended so as to include the Hackethal Company, of Hanover.

Sweden's Foreign Trade.—During the seven months ended with July the imports of electrical machinery into Sweden amounted to 6,577 tons, as compared with 8,321 tons in the corresponding period of 1920, and those of machinery and engines, &c., were 29,672 tons and 39,305 tons in the same terms of the two years respectively. On the other hand, the exports of electrical machinery reached 10,779 tons in the first seven months, and contrast with 8,103 tons in the same period in 1920; those of telephone and telegraph apparatus were 9,661 tons and 3,761 tons, and those of internal combustion engines were 7,774 tons and 14,347 tons in the seven months of the two years respectively.

The Burden of Taxation.—At a meeting of the Electrical Wholesalers' Federation on September 17th, the following resolution was passed: "That the Federation of Electrical Wholesalers consider that taxation exceeds the limits that commerce can bear, and that much more drastic economy than hitherto practised is essential for the welfare of the country."

Lead.—Messrs. James Forster & Co., reporting under date September 17th, state.—"The position of the metal, apart from speculation, is that arrivals continue quite equal to consumption, which is poor and without much prospect of improvement. Indeed, rather the contrary is true, as the electrical trade, which has for so long been busy and fully occupied, has fallen off greatly, and for the first time in the last two years important works are on short time."

The Ideal Homes Exhibition, Glasgow.—As was to be expected, the Ideal Homes Exhibition, held under the auspices of the Glasgow Corporation, has afforded manufacturers and agents of electrical appliances a splendid opportunity for displaying their goods. That they have made the very best use of it a visitor to the Kelvin Hall will freely admit.

Electrical goods of all descriptions occupy prominent places on the stalls, and the bright displays to be seen banish gloomy thoughts of dull trade and hard times. The exhibition, which was formally opened by Lady Blythswood on Monday, will continue till October 8th.

As is only fitting, the two stands displaying the goods of the Glasgow Corporation Electricity Department are prominent. Demonstrations are given showing the varied uses of electricity, and the very latest heating, cooking and ironing appliances are exhibited. In fact, almost everything electrical on the market, designed to reduce household drudgery, can be inspected. A feature is made of coloured screen lighting for show windows; this is the first occasion so far as this country is concerned on which coloured screen lighting has been seen. Importance is attached to an American Universal cooking range, which, we understand, the Corporation intends to put out for hire shortly. There is a very striking notice displayed on the Corporation stand reminding builders that they can save money by installing electricity for heating and cooking in new houses, no chimneys, &c., being required.

Carron Company, of Stirlingshire, has an attractive show of its well-known electric cooking appliances. Particular attention is attracted by a combination cooker, the over of which is loaded to a maximum of 1,250 watts and the hot plate to 1,600 watts, arranged for heat regulation.

Messrs. David Alexander & Co., representatives for Scotland, show the Austin automatic lighting sets suitable for private installations in country houses, farms, &c. The Austin 0.75-kW Autoplant attracted attention on the stand.

Messrs. Beatty Bros., Ltd., have a display of electric washing machines that is sure to attract the housewife, while the Electric Suction Cleaner Co., of Croydon, also makes a strong appeal with its stand. The small electric power motors shown by the latter company, suitable for driving small domestic machines, proved particularly interesting to visitors.

Magic Appliances, Ltd., London, show their suction cleaner, as well as an electric blower. Other companies displaying useful electric appliances are the "Gem" Labour-saving Device Co., Manchester; Doric Import Co., Glasgow; the "Bell" Washer Co., Blackburn; the Hoover Suction Sweeper Co., Ltd., London; Coggans & Co., Glasgow (electrical fixtures); Pollock & Co., Glasgow; James Meighan & Son, Glasgow (electrical fittings); the Electric Appliances Co., Glasgow; the Falkirk Iron Co., Ltd. (electric cookers and heaters); Western Electric Co., Ltd., London; Vickers, Ltd.; C. F. Howden, heating and ventilating engineer and electrical engineer, Glasgow (a fine display of electrical labour-saving appliances); Rogers Electric Sales Co., London, &c. The North British Rubber Co., Ltd., appeals to a wide circle by its display, and Bell's United Asbestos Co., Ltd., Glasgow, has also a fine stand.

B.T.H. Advertising.—The British Thomson-Houston Co., Ltd., has secured the services of well-known artists in the execution of two new show-cards. Mr. Heath-Robinson deals in a humorously fantastic vein with lamp tests, and Mr. Septimus Scott, in a symbolical picture called "light," has produced a work of high artistic merit.

Tok Switches now Available.—We are pleased to learn from Messrs. Tok Switches, Ltd., of Granville House, Arundel Street, London, W.C. 2, that they are now in a position to supply a full range of their rotary snap switches—single and double-pole, series-parallel, two and three-circuit, and two and four-way. The company does not hesitate to admit that in its earlier days its products were not all that they might have been, and that some of its clients had reasonable ground for complaint; but it has learnt the lessons taught in the costly but efficient school of experience, has eliminated the faults met with in its first designs, and now claims that its switches are *at least* as good as the American-made switches; moreover, they are wholly British-made, and are sold at competitive prices, on their own merits.

The design of the switches has been improved in detail, and several samples that we have inspected appear to be all that could be desired in point of external finish (black oxidised metal with a moulded key, or nickel plated with a porcelain key), sweetness in working, and excellence of workmanship. A notable improvement has been made in the dial, which is depressed sufficiently to ensure that the figures shall not be rubbed off in use. The makers ask for "a fair field and no favour," to enable them to prove that their products meet the needs of present day practice—particularly in connection with heating and cooking apparatus, for which tumbler switches are not suitable.

Celluloid in Factories.—In view of the new regulations drafted by the Home Secretary, dealing with places in which celluloid or any article partly made of celluloid is manufactured, manipulated or stored, the British Cellulose & Chemical Mfg. Co., Ltd., reminds us that "Celastoid,' the new safety celluloid made by it, is non-flam. and safe to use, takes the place of explosive celluloid satisfactorily, and is made by British labour.

LIGHTING AND POWER NOTES.

Accrington.—Extensions not Approved.—The Electricity Commissioners have refused to sanction the application of Accrington Corporation for borrowing powers for £126,850 for electricity extensions. A deputation from the Corporation travelled to London to place further arguments before the authorities, and to prevail upon them to reverse this decision. They were given a favourable hearing, but the decision was postponed. The Commissioners suggest that Accrington's needs might be met by entering into arrangements with Blackburn. To that course the Accrington Electricity Committee will not agree. Blackburn Corporation established its station when costs were high, and it is estimated to have cost £800,000, an annual charge of £80,000, which can only be met if the station is fully engaged. The bulk of the Accrington station was laid down when costs were lower.

Ayr.—The Loch Doon Scheme.—At a recent public meeting, Councillor Paterson explained the present position of the Loch Doon electricity scheme. He said that the production of 40,000,000 units by Kilmarnock would cost about £32,000, while a similar quantity from the Loch Doon undertaking would cost only about £24,000. In any case the present generating station would have to be closed down, but if the water-power scheme were proceeded with, the station would be used for distribution purposes. The speaker thought a long time would elapse before it would be possible to obtain power from Loch Doon, as there were long negotiations to be got through.

Aberdeen.—Year's Working.—The annual report of the city electrical engineer (Mr. J. A. Bell) for the year ended July 31st last shows that the revenue of the electricity undertaking was £173,820, an increase on the preceding year of £25,287. Working expenses were £122,486, as against £95,687, leaving a gross profit of £51,334. After the payment of capital the previous year there was a net profit of £13,789. The decrease in profit is due chiefly to the capital charges being increased by £11,972.

Australia.—Melbourne.—During the first five months of the present year, the City Electricity Department incurred a loss of £338; the result for the equivalent period of last year was a profit of £13,885. This adverse result is attributed partly to the rise in labour costs and partly to the effects of the restrictions imposed during the shipping strike of January and February.

Barnsley.—Loan Sanctioned.—The Town Council has received sanction to loans of £18,573 for mains and services, £1,533 for sub-stations and equipment, and £1,449 for meters and current limiters.

Bishop's Lydeard (Somerset).—Electricity Supply.—At a parish meeting, Mr. A. Howard, electrical engineer, of Taunton, stated that the cost of supplying electricity throughout the parish would be approximately £1,500.

Blackburn.—Electricity Supply.—The Mill Hill district is being provided with a supply of electricity from Blackburn's new station.

Canada.—Power Development.—Plant is being erected by the Winnipeg Railway Co., at Great Falls, on the Winnipeg river, at a cost of 10,000,000 dollars, which will have a capacity of 18,000 h.p.—*Reuter's Trade Service.*

Carlisle.—New Plant.—At a meeting of the City Council on the 13th inst. the Electricity Committee reported upon the proposal to erect a new generating station at a cost of £200,000, and recommended that this scheme should be deferred, but that a 3,000-kW turbo-alternator should be installed temporarily at the existing works, at a cost of £40,000, to tide over the requirements of the coming winter, for which the present plant was inadequate. The Council approved the proposal.

The Gretna Station.—The Electricity Committee reported having had under consideration a letter from the Secretary of the Gretna Committee of the Disposals Commission inquiring if the Council would be willing to purchase the electric power station at Gretna, and supply power to any firm or firms which might purchase the factory or construct works in the area. The Electricity Committee had decided to communicate with the Electricity Commissioners and ask their views on the proposals. The Council confirmed the action of the Committee. It was explained that if the Gretna power station were acquired it would not remove the need for the new generator; for the acquisition of Gretna, if decided upon, would take considerable time.

Cardiff.—Reduced Charges.—In view of the reduced price of coal, together with the increased revenue on account of the output for the last financial year being up about one and three-quarter million units, the Electrical Committee has approved a recommendation of the city electrical engineer (Mr. C. G. Morley New) to reduce the additional charge of 90 per cent. now in force, to 75 per cent. over pre-war basic rates, commencing from October 1st. It is also hoped that further concessions will be made in the near future. Subject to confirmation by the Council, the new *maximum* rates will be as follows: Lighting, 6½d.; heating, 1½d.; power, 2½d. per

unit. In addition to these rates there are special power rates for large supplies, subject to a coal and wages clause, which will automatically receive the benefit of the reduced operating costs.

Crieff (Perthshire).—Proposed Electricity Scheme.—Mr. J. E. Macewan, electrical engineer, Glasgow, and electrical adviser to the Town Council, owing to pressure of work, is unable meantime to continue to act in that capacity. It has been agreed to submit Mr. Macewan's report on the proposed electricity scheme for the town to the Electricity Commissioners.

Continental.—Belgium.—Following the decision of the Provincial Council of Limbourg to supply electricity to the whole province from the powerful generating stations at the collieries, the setting up of the first post of the first network undertaken was carried out with great ceremony at Winterslag-sous-Genck on August 16th. This section, which is 45 km. in length, is comprised in the circle Genck-Hasselt-Saint Trond-Cortessem-Diepenbeck-Genck, and the contract has been secured by the Société Electrique de la Campine, which expects to complete it by the end of the year.

Doncaster.—Condensing Water.—Following on a report by the electrical engineer on the need for further water supplies for condensing at the electricity works, the Electricity Committee has recommended the acceptance of an offer by the South Yorkshire Navigation Co. to supply from the canal for £127 per annum. The committee also agreed to the purchase from Colchester of a circulating water screen for the new condensing plant, and to the purchase from Oxford of l.p. switchgear for the Carr House Road sub-station.

Dover.—Loans.—The Electricity Commissioners have sanctioned the borrowing by the Council of £3,000 for mains and services, and £250 for transformers. Permission is being sought to borrow a further £8,000, including £4,000 for the St. Margaret's extension.

Eastbourne.—Power Station Fire.—A destructive fire occurred at the Corporation electricity works on September 10th. The outbreak started in the boiler house, and was due to an overflow from an oil tank becoming ignited. The flames were fanned by a strong westerly gale, but the brigade got the fire under in about an hour. The damage is estimated at about £1,000.—*Star.*

Edinburgh.—Price Revision.—The Corporation Electricity Committee has agreed to rescind the resolution to increase the charge for lighting by ¼d. per unit, and for power and heating by ½d. per unit, and to increase lighting by ¼d., no change being made in respect of power and heating.

Federated Malay States.—Electric Power Scheme.—With reference to the decision arrived at earlier in the year to provide a public electricity supply to the Federated Malay States, an electrical staff has been appointed at a cost of $150,000 for salaries and expenses. The preliminary survey by the Government Electrical Advisor calls for an expenditure of approximately $40,000,000. As the scheme matures the great facilities it will afford industrial development are being appreciated. This is particularly the case as regards tin mining. So far as this particular industry is concerned, however, the question of generating on a large scale has been discussed many times, when it has been held by experts that the prospects of a power company would not be very promising.—*Eastern Engineering.*

Greenock.—Staff's Wages.—During the recent discussions upon the salaries of the technical staff employed at the Dellingburn Station, the Provost is reported to have said that the increases due to the application of the E.P.E.A. schedule amounted to £32,000. Mr. J. W. Thomas, assistant secretary of the E.P.E.A., has written to the *Greenock Telegraph*, protesting against this statement. He says the actual increase has only been £2,700. Mr. Thomas further states that if the Corporation considers the salaries under the award too nigh, the correct procedure is to submit the case to the District Joint Board for Scotland, on which it has a representative. It is also pointed out that owing to a recent fall in the cost of living, the amount paid has already been reduced by £550 per annum.

Halifax.—Price Revision.—Some discontent has been expressed lately with regard to the local charges for electricity for power. It has been alleged that the increases on last quarter's accounts involved a 300 per cent. advance in some cases. The increases were based on calculations to cover coal costs during the strike period. A sub-committee has, therefore, decided upon certain rectifications under which power users, instead of paying the increases which have caused criticism, will pay a penny per kWh more than on their previous accounts.

Hay.—Street Lighting.—The Urban District Council has accepted the tender of the Electric Light Co. for public lighting from October 1st to April 1st, at £2 per lamp, plus £78 for new standards and installation.

Hawarden.—Electricity Supply.—Permission is being sought of the Electricity Commissioners for the supply of electricity throughout the district.

Harrogate.—Electric Lighting Order.—The Council has asked the Electricity Commissioners to fix a date to enable the Harrogate Electric Lighting (Extension) Order, 1915, to operate immediately.

Ilkley.—Loan Sanctioned.—The Council has received permission to borrow £11,000 for electrical plant and materials.

India.—Gersoppa Falls Development.—Plans have now been prepared by the Mysore Government for the construction of a dam on the Gersoppa Falls, about 120 ft. high, which will create a reservoir with a capacity of some 42,000 million cu. ft. It is proposed to build a power-house about 153 ft. below the bottom of the Falls, so that a total fall of nearly 1,000 ft. will be secured for the volume of water. It is estimated that by this means hydro-electric power to the extent of 100,000 h.p. can be produced. This will be utilised for the development of the north-western districts of Mysore. The cost of the scheme is put at nearly £3,000,000.—*Indian Textile Journal.*

Power Schemes Sanctioned.—In connection with the encouragement of hydro-electric schemes, the Department of Industries, Punjab, has already secured on behalf of the Punjab Hydro-Electric and Industry Department Association, Delhi, sanction to establish four power-houses on the Jhelum and Upper Chenab Canals, namely, Rasul (15,000 b.h.p.) Upper Bhimber Weir (10,000 b.h.p.), Gujranwala (3,000 b.h.p.), and Joynawala (3,000 b.h.p.):—*Indian Textile Journal.*

The Nilgiri Scheme.—Messrs. Tata, Sons & Co. have secured a licence for the Nilgiri hydro-electric scheme.—*Reuter's Trade Service* (Bombay).

Knaresborough.—Time Extension Required.—The Electricity Commissioners have reminded the Council that its Electric Lighting Order lapsed on August 31st, the official termination of the War. They asked if a time extension was required, and the Council has decided to reply in the affirmative.

Lytham.—Prospect of Early Supply.—The proposal of the St. Annes Council to extend its electricity mains into Lytham has reached a definite stage. The Council has resolved that an application be made to the Electricity Commissioners for a loan of £9,740. The estimated cost of the cables and laying them for a distance of about four miles is £6,460; disconnecting pillars and section boxes £390; services including cable, boxes, and accessories, £1,250; meters (100), £320; making good the footpaths broken up, £1,320.—*Blackpool Gazette & Herald.*

Lamberthurst (Sussex).—Electricity Supply from Mill.—Col. F. G. Delamain has been instrumental in obtaining a supply of electricity for the village, by means of a disused mill, 400 years old. A 40-h.p. vertical shaft turbine has been installed, and this is coupled to a 15-kW generator, which supplies about twenty houses with energy for lighting. A charge of 1s. per unit is made.

Leominster.—Housing Scheme Supply.—The Housing Commissioner has notified the Town Council that the Government is not prepared to contribute towards the cost of laying electricity mains to the site of the Council's new houses. The Council intends to press the matter again.

Matlock.—Report on Derwent Scheme.—In a recently published report by the consultants engaged by the Council to report upon the possibilities of obtaining power from the Derwent the maximum load is estimated at about 150 kW, or 200 h.p., though this might take some years to develop. Selling up to 140,000 units per annum, the average load during the year would only be about 11 per cent. of the maximum. If this was sold at 6d.per unit the revenue would be about £3,500 a year. The cost of the proposed power station would be £13,000, and besides this there would be £10,000, the cost of ten miles of distribution cables. The cost of running would be £2,000 a year, and added to this there would be 7 per cent. and 5 per cent. on the sinking fund on a capital expenditure of £23,000, the total running cost thus being £4,760 a year. This showed a loss of £1,260 a year on the estimated revenue, or otherwise it demanded that the price per unit should be 8¼d.

An alternative scheme to the river power was an extension of the recently installed gas suction plant which runs the town's cable tramway. This would cost £18,500, and the running would cost £4,350, making a loss of £850, unless the price per unit was raised to 7¼d.—*Manchester Guardian.*

Milnrow.—Bulk Supply.—A sub-committee has been appointed to inquire into the Rochdale Corporation's offer of a bulk supply of electricity, and to take steps to obtain a Provisional Order for the supply of electricity.

Newport (Isle of Wight).—Increased Charge Opposed.—The Town Council has decided to oppose the application of the Isle of Wight Electric Light Co. for power to increase the maximum charge for electric lighting from 10d. to 1s. per unit.

Newcastle-on-Tyne.—Improved Lighting.—It is stated that the 60 per cent. lighting from August 16th to September 30th, and 100 per cent. lighting from October 1st to December 31st inclusive, which have been agreed to, will cost £11,708; this being an excess of £6,646 over the estimates approved by the Council. It is anticipated, however, that savings on salaries, wages, and electricity will amount to £1,798, and it is proposed to apply that sum in reduction of the proposed excess expenditure, reducing the latter to £4,848.—*Newcastle Chronicle.*

New Zealand.—Hydro-electric Developments.—A survey of the progress made in the development of hydro-electric power has been published in Wellington. Following are the principal works actually in operation: Waipori Falls, Dunedin City Council, 8,000 h.p., to be extended in early future to 16,000 h.p., and possibly to 25,000 h.p.; Lake Coleridge Public Works Department, 8,000 h.p., to be extended to 16,000 h.p., with an ultimate development of 40,000 h.p.; Horahora Rapids, installed by Waihi Goldmining Co., and purchased by the Public Works Department, 8,000 h.p., to be extended to 10,000 h.p.; Wairura Falls, Dominion Portland Cement Co., 3,000 h.p.; New Plymouth Borough Council, 1,000 h.p., to be extended to 6,000 h.p.; Tauranga Borough Council, Omanawa, 1,000 h.p., possibly more; Hawera Electric Supply Co., 600 h.p. There are about 20 smaller schemes, accounting for about 3,000 h.p. Definite commitments have been made for other schemes as follows:— Southland Electric Power Board, 8,000 h.p., with possible extension to 20,000 h.p.; Mangahao, Public Works Department, 24,000 h.p.; Waikaremoana, Public Works Department, 40,000 h.p., with an ultimate capacity of 136,000 h.p.; Waikato, 96,000 h.p. —*Auckland Weekly News.*

Auckland.—The estimates of the city electricity department's requirements for extension purposes, for the next two years, by the electrical engineer, are as follows.— Services, £10,000; meters, £15,000; distributors, £30,000; sub-station and feeder extensions and switchgear, £26,000; and wages to workmen, &c., engaged on extension work, £10,000.

Peterborough.—Electricity Supply.—The Rural District Council has consented to the supply by the City Council of electricity to 50 houses in course of erection in St. Paul's Road and Paston Lane.

Sheffield.—Year's Working.—The number of units sold during the year ended March 31st last was 9,182,951 more than the previous year, an increase of nearly 7 per cent., and but for the coal strike and trade depression this increase would have been very much greater. The average prices obtained were 3.88d. for light and heat, and 1.41d. for power, giving a total average for 1921 of 1.65d. The accounts show that the capital expenditure on the undertaking to March 25th, 1920, was £3,021,096. During the year, £419,345 was expended on capital account, making the total to March 31st last £3,440,431. The revenue account shows that the income from electric supply was £982,456, and from installation and motors £99,479, making a total of £1,082,025; and the expenditure £705,407, leaving a balance of £376,618. Interest, sinking fund, and income tax take up £260,288, leaving £116,329. To this is added £15,493 balance to March 25th, 1920, and £61,144 balance after settlement of income tax account to March, 1919, and these bring the total balance up to £192,968. The sum of £1,000 has been transferred to the motors and cookers fund; £100,000 to the renewals and special expenditure fund, £73,357 to the reserve fund, and £18,611 for depreciation of stocks. These total £192,968, and balance the account. The amount paid to sinking fund, with accumulations, for reduction of debts, to March 31st, 1921, is £1,048,072.—*Sheffield Daily Telegraph.*

Skegness.—Time Extension Refused.—The Electricity Commissioners have notified the Council that they cannot see their way to recommend any further extension of time for the execution of the works necessary to provide an electricity supply for the town. They are willing, however, to listen to any further representations the Council cares to make. The Council has asked a local electrical engineer for his views and suggestions on the matter.

Swinton.—Loan.—The Urban District Council has applied for a loan of £15,930 for electricity purposes.

Strichen (Aberdeen).—Street Lighting.—The Town Council has accepted the tender of Messrs. T. C. Smith to carry out the electric lighting of the town.

United States. — Hydro-electric Development in California.—Among the Californian projects completed within the last twelve months are the Kerckoff plant of the San Joaquin Light and Power Corporation, which added 45,000 h.p. to the service of the San Joaquin farms, and also the natural gas-burning plant of the same company near McKittredge, with a capacity of 20,000 h.p. An equivalent installation has been added to the Bakersfield plant, doubling its capacity. The Southern California Edison Co. has added three new important units, all of them completed during 1921. The first to come into service was the 40,000-h.p. installation on the Kern River, supplying energy over the Greenhorn Mountains to the Vestal sub-station, where it connects with the Big Creek line. Soon after this a third unit, with 22,000 h.p. capacity, was added to Big Creek plant No. 1. Big Creek No 8 has just been completed with an initial capacity of 30,000 h.p..

The Great Western Power Co. completed its Cariboum plant early this year. This increased the capacity of the system by 59,000 h.p.; power is transmitted at 165,000 V.; at the beginning of 1920, the total available power in Californian power plants amounted to just about one million h.p. This capacity has now been increased by 25 per cent., and there is sufficient construction work actually under way by Californian power companies to bring this figure to one and a half million h.p. within another year.—*Reuter's Trade Service* (San Francisco).

Walsall.—Extension of Supply.—The Walsall authorities propose to ask the Electricity Commissioners for sanction to supply electricity to Shelfield and Daw End Lane, Rushall.

West Cornforth.—Electricity Supply.—The Thirlington Colliery Co. has offered to supply electricity for lighting West and Old Cornforth (Co. Durham) at a charge of 4d. per unit. The Council has decided to seek power to raise a loan and to prepare estimates for carrying the proposed scheme into effect.

TRAMWAY AND RAILWAY NOTES.

Australia.—Railway Electrification.—The latest line to be electrified in the Melbourne and suburban area is that from Clifton Hill to Heidelberg, on which a trial run was made on July 23rd. A three-unit, or six carriage, train was taken over the route, and run to a fixed schedule, so that the exact amount of electrical energy consumed might be noted, and the maximum coasting power ascertained. The trial trains were not available for passengers, but carried electrification officials. The run was successful. A regular service was started on July 24th. For some days the trains ran to the steam train schedule, and then took up the faster electric running.—*Industrial Australian and Mining Standard.*

China (Peking).—A report dated July, from China, stated that consequent on the suspension of payment of the Banque Industrielle de Chine, which held the French shares, the board of directors of the Peking Tramway Co. had petitioned the Government to cancel the Sino-French agreement in connection with the formation of the organisation, so that it might be converted into a purely Chinese enterprise. The Ministry of Finance had appropriated $500,000 for Government shares so as to enable the work to continue without interruption. The Ministry of Foreign Affairs was negotiating with the French authorities to secure the cancellation of the agreement.

Continental.—Sweden.—The completion has taken place of the work of converting to electric traction the railway which connects the blast furnaces and rolling mills at Hagfors, Sweden, with the iron ore mines belonging to the Uddenolm Co. at Finnshyttan. The 15 locomotives which were ordered from Germany in 1919 have been delivered. Each weighs 41 tons and is able to haul a load of 350 tons in normal service. Alternating current at 10,000 volts is used, as in the case of the Kiruna railway to the Norwegian frontier.

Germany.—Constructional work in connection with the electrification of the Berlin metropolitan railways has been started on the northern lines. The first line, running from the Stettiner terminus to Bernau, is expected to be completed by the spring of 1923. Power for these lines will be taken from the Berlin electric power supply stations, and for the inner circuit from the lignite-fired long-distance power plant at Golpa, near Halle (Central Germany, 150 miles distant from Berlin). It is hoped to complete the entire scheme within ten years.—*Times Trade Supplement.*

Holland.—A translation of the report of the Special Commission appointed by the Government to study the question of electrifying the Dutch railways recently appeared in *The Electric Railway and Tramway Journal.* After a comprehensive tour and exhaustive studies of the systems in use on the Continent, in America, and in this country, the Commission has arrived at the following general conclusions (*inter alia*):— Even if no national electricity supply is formed, the electrification of the Dutch railway system must take place on the direct-current system and with a working pressure of 1,500 V. Now that the Dutch railways have to make a start with the electrification, before there is any certainty as to the formation of a national electricity supply, it is desirable that in generating power at high pressure a frequency of 50 cycles should be adopted. The method of collection is not dealt with in the report, but this will probably be left for decision by Dutch engineers.

Finland.—The State Railway Administration has under consideration the question of the electrification of the Riihimaki-Viborg railway, and a scheme for this purpose is to be completed this year. Then proposals will be made for the conversion of the other railways in South Finland. It is in contemplation to utilise the falls of the Kymmene river and of the Vuoksen.

Dartford.—Loan Sanctioned.—The Urban District Council has received sanction to a loan of £12,000 for the repair and reconstruction of the tramway track.

Doncaster.—Proposed Extensions.—The Town Council is to apply for sanction to the construction of a light railway connecting the tramways in Frenchgate and St. Sepulchregate to form a circular route. The project is estimated to cost about £10,000.

Halifax.—Sunday Service.—The Tramways Sub-Committee recommends the restoration of Sunday tramway services to pre-war level, which advances the hour of commencement

from 2 p.m. to 1 p.m. It has also been decided to give a trial to workmen's fares on the Wainstalls railless route and on the motor 'buses to Siddal, with an increased service to Wainstalls between 5 and 7 p.m.

London.—Tube Extensions.—Reports that the extension of London's tube railways is to be undertaken at an early date are devoid of foundation. It is stated at Electric Railway House that the position is practically the same as in February, when Lord Ashfield informed the shareholders of the company that it was hoped to proceed with the scheme when conditions permitted and the required sum of £1,750,000 could be raised on reasonable terms. The matter is still one of finance, and no information could be given as to when the work was likely to be undertaken.—*Financial Times.*

Salford.—Strike Ended.—The tramway strike in Salford, which began on September 12th, ended on Saturday. The suspension cost Salford £1,000 a day.—*The Times.*

Stockport.—Track Reconstruction.—The Town Council has decided to have the tramway track in Warren Street reconstructed at an estimated cost of £1,200.

Tynemouth.—Accident.—The report of Major G. L. Hall to the Ministry of Transport on the tramcar accident which took place on July 31st, when five persons were killed and nine seriously injured, indicates that the driver lost control of the car by too sudden an application of the hand brake, and that the track brake was never sufficiently applied. This was the second accident within two years on the Borough Bank. The driver is held responsible, but the conductor is not acquitted of blame. Disciplinary action is recommended to ensure obedience to the authorised speed limits and the compulsory stops; more thorough training of the staff; and an improved slipper block. It is pointed out that the short-circuit emergency brake fitted on some of the cars is not now accepted as an adequate electric brake, and that a rheostatic brake should be provided.

York.—Railless Traction.—At York, railless cars are now running between Market Square and Heworth, a distance of about a mile and a quarter. Here the route within the city runs through narrow and tortuous streets on which tramways would be impracticable, and though both petrol omnibuses and electrical vehicles deriving their current from storage batteries have been tried on it, the results are said to have been unsatisfactory, the former proving costly and troublesome and the latter too slow. The railless vehicles employed are only 6¼ ft. wide over all, and are designed on the "one-man" principle. The entrance door is in front, under the control of the driver, and the passengers drop their fares into a "pay-as-you-enter" device. Power is supplied from two overhead wires through two trolleys, which are long enough to enable the cars to deviate 17 ft. from the centre of the road. Their running costs (power, solid rubber tires, and wages) are 11½d. per car mile, or 1s. 7d. including capital charges. The consumption of electricity is 1.42 units per car mile; this is supplied from the municipal power station at 2d. per unit. The cars are of the single-deck type, seating 24 passengers.—*Nottingham Guardian.*

Walsall.—Linking-up Tramways.—The tramway manager has been authorised to negotiate with the Wolverhampton Corporation and the Wolverhampton District Electric Tramways, Ltd., for a through service between Walsall and Wolverhampton.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—Wireless Telephony on Trains.—Wireless telephones will be installed on a number of important German express trains, and receiving instruments will be placed in hotels and Embassies at Berlin, according to an announcement from that city. The tests were made under the observation of engineers, military attachés and diplomatic representatives of the United States and Sweden, says the *Railway Review.*

Italy.—New Cable.—The Rome newspapers congratulate the Government on having concluded an agreement for the provision of a direct telegraph cable to South America. The *Morning Post* announces that the cable will be 13,000 km. long, will cost 30 million gold francs, and is to be completed in three years' time. On this subject the *Tribuna* says: "To have established direct communication with the South American States, which are bound to Italy by constant commercial intercourse, constitutes a solution of the problem of political liberty and economic and commercial independence. Although Italy has nearly eight millions of her subjects scattered throughout the States of South America, she had formerly no means of communicating with them except by the British, French, and Germany cables, which meant that other States were able to exercise control in both public and private transactions between the Italians of Europe and those of South America. The new cable will start from Fiumicino (Rome) and will touch Spain, Brazil, Uruguay, and Argentina, and eventually the Canaries and Cape Verde Islands.—*Reuter's Trade Service* (Rome).

Jan Mayen Island.—A wireless weather intelligence station has been established at Jan Mayen Island by the Norske Radio Co., and is now in communication with stations at Rost, Norway, Iceland, and Spitzbergen.

London.—New Toll Exchange.—On Saturday last the Postmaster-General opened the new toll exchange in Norwich Street, in the presence of a number of officials and visitors. He stated that the number of trunk calls to and from London was about 12,000,000 per annum, and about 35 per cent. of this traffic was included within the range of the new exchange—a radius of about 25 miles. The nature of the new service was explained in our last issue, p. 371. Mr. Kellaway said it was hoped ultimately to extend the radius of the toll service to 50 miles. The relief afforded to the trunk service by the inauguration of the toll exchange would accelerate the former. During the first eight months of this year 78,000 new stations had been connected up; the number of subscribers who gave up the telephone on account of the increased charges was 28,900, about 5 per cent. of the total. Thousands of people wanted telephones, but could not be supplied with them on account of the shortage of equipment. This year 75,000 miles of double wire had been laid with a view to improving the trunk service and reducing delays. Since the new tariff was introduced there had been a falling-off in the number of trunk calls by the end of August of 12½ per cent. compared with last year, but the revenue increased by 50 per cent.

Sweden.—Mines Anchored to Submarine Cables.—The cable steamer *H. C. Orsted*, belonging to the Great Northern Telegraph Co., has just started to effect repairs on the cables connecting Sweden and Finland, after a stay of five months in the North Sea. During this period the cable staff were occupied in repairing the cables between Denmark, France, and England. These were found to be in a very defective condition because, besides seizing cables, the Germans, in laying mines, anchored them to the cables. It was necessary to repair six cables, which work was carried out under great difficulties, this accounting for the long stay in the North Sea. It is submitted that the Germans ought to be made to defray the heavy cost of effecting the repairs, as the anchoring attachments remaining on the cables are said to prove that they were the cause of the damage done.

Spain.—A large number of towns in Spain are about to be provided with telephonic exchanges, all of which are to be linked up to the system of the Compania Peninsula de Telefonos.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

November. State Railways. One year's supply of railway signal material, including telephone and telegraph materials, &c.*

Australia.—Melbourne.—Victorian Government Railways. October 26th. D.c. arc welding plant (Cont. No. 34,377). Armature banding machine with electric motor and starting gear (Cont. 34,378).

November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

January 4th. Victorian Government Railways. 150 electric train stops operated by a single-phase induction motor. One set of electric pyrometer equipment for measuring temperatures of 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

Adelaide.—October 12th. Postmaster-General's Department. 2,750 yds. telephone cords, 120 hand sets, 160 jacks.*

Belgium.—Belgian Ministry of National Defence is carrying through a large scheme for establishing electric lighting installations in the various military establishments and barracks throughout the country. The latest contracts for which tenders have just been invited are for an installation at the Fort at Edeghem-lez-Anvers and for one in the military depôt at Contich.

Bulgaria.—Sofia.—October 7th. Department of Posts and Telegraphs, 100,000 porcelain insulators.*

Edinburgh.—Midlothian and Peebles District Asylum, Rosslynlee. Stores, including electric fittings. Clerk and treasurer, 19, Heriot Row, Edinburgh.

October 10th. Corporation. Electric lighting installation at the city collector's offices, Waterloo Place. Engineer's office, Dewar Place.

Liverpool.—September 24th. West Derby Board of Guardians. Electrical supplies. Mr. H. B. Cleaver, clerk, Brougham Terrace.

Loughborough.—October 31sf. Electricity Department. Steam-raising plant, h.p. and l.p. mains networks. (See this issue.)

London.—H.M. Office of Works. September 30th. Electric wire and cable. (See this issue.)

New Zealand.—Wellington.—November 29th. Public Works Tender Board, Mangahao power scheme. Water wheels, generators, 3-unit exciters, transformers, 110,000-V insulators, lightning arresters, switchboard, switches, and accessories. (See this issue.)

Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor (spec. No. 87).*

Nottingham.—October 21st. Electricity Department. Three 10,000-kW turbo-alternators with exciters, condensers, auxiliary plant, &c. One 1,000-kW combined turbo-generator-alternator with condenser, auxiliary plant, &c. Six water-tube boilers with mechanical stokers, superheaters, forced draught fans, &c. (September 16th.)

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (September 2nd.)

South Africa.—Johannesburg.—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

Warrington.—September 27th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, Bewsey Chambers.

Worksop.—Urban District Council Electricity Department. Supply and erection of an overhead transmission line, complete with underground connecting cables, distance approx. 2,200 yds., pressure 6,600 V. (September 16th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Aylesbury.—Town Council:—

Electrical pumping plant, sewage works, £2,273.—E. T. Mackrill & Sons.

Belgium.—The Société Nationale Radio-Electrique, of Brussels, last week submitted the lowest tender to the Belgian Ministry of National Defence for the establishment of two wireless stations capable of transmitting telephone messages up to a distance of 150 kilometres and telegrams up to 500 miles. Three concerns competed for the contract for equipping 20 stations capable of dealing with telephone messages up to 30 kilometres and telegrams up to 100 kilometres, the lowest offer being that of the Société Electricité et Mécanique, of Brussels.

Doncaster.—Town Council:—

Circulating water screen for condensing plant, £394.—Brackett & Co.

Erith.—Urban District Council:—

Power station switchgear, £551; cubicle, £180.—English Electric Co., Ltd.
Sub-station equipment, £293.—Metropolitan-Vickers Electrical Co., Ltd.
Transformers, £4,747.—British Electric Transformer Co., Ltd.
Three-core cable, lead sheathed and steel armoured (approx), £2,500.—Callender's Cable, &c., Co., Ltd.

Hay.—Urban District Council:—

Installation of seven points, 18 houses, £189.—Hay Electric Light Co.

London.—Stoke Newington.—Electricity Committee. Recommended:—

Alterations and additions to sub-station wiring, £126.—R. Stephenson.

Macclesfield.—Infirmary Governors:—

Electric light installation, infirmary, £275.—Mr. W. R. Brown.

Maidstone:—

Electric light installation, West Kent Hospital extensions, £211.—Mr. W. E. Cogger. (Accepted.)

Sunderland.—Electricity Committee. Accepted:—

5-ampere meters.—Ferranti, Ltd., Reason Manufacturing Co., Ltd.
Gear for testing a.c. meters.—Elliott Brothers.
Loading resistance for a.c. meter testing.—Cressall Manufacturing Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.

Tramways Committee. Accepted:—

Cast-iron pipework.—T. Allan & Sons.
Time clocks.—Gledhill-Brook Time Recorders, Ltd.

The Corporation has turned down the Tramways Committee's recommendation to accept the tender of the Equipment & Engineering Co., Ltd., for rails, fish plates, &c. The only English tender received was from a Middlesbrough firm whose price was in excess of that of the Equipment and Engineering Co., Ltd. The English tender was £1,744, against the foreign tender of £1,450.

FORTHCOMING EVENTS.

Faraday Society.—Wednesday, September 28th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 4.30 p.m. Discussion on "Radiation Theory of Chemical Action," to be opened by Prof. J. Perrin, and on "Heterogeneous Reactions," to be opened by Dr. Langmuir.

Municipal Tramways Association (Incorp.).—September 28th, 29th, and 30th. At the Technical Institute, Salford. Annual conference.

NOTES.

Smoking Concert.—The L.E.E.O.C.A. (London Electrical Engineers' Old Comrades' Association) will hold a smoking concert at the Bridge House Hotel, London Bridge, on Thursday, October 6th, at 7 p.m. Admission by membership card. Mr. F. Frankling, of 108, Heathwood Gardens, Charlton, S.E.7, is the hon. secretary.

International Tramways Association.—In view of the recent conference of the new International Tramways Association at Vienna (Electrical Review, September 2nd) *The Electric Railway and Tramway Journal* has undertaken to ascertain the position of the original Association. It was found that the General Secretary had communicated with members, and had received 250 assents to the dissolution of the original body and the formation of a new one. There having been some dissension to this course from neutral sources, a new circular will probably be issued shortly. It is expected that a General Assembly and Congress will be held next year, and it is hoped that British undertakings will participate; to this end it has been proposed that English shall be one of the "official" languages for the meeting.

Appointments Vacant.—Electrician (83s. 7d.), for the Croydon Mental Hospital, Warlingham; instructor in oxy-acetylene and electric welding (£300), for the Loughborough College; assistant electrical engineer, for the Holmfirth Urban District Council Electricity Department; electrical fitter (£500), for the Government of the Gold Coast Public Works Department. (See our advertisement pages to-day.)

Faraday House Old Students' Dinner.—It has been decided by the committee to hold the annual dinner at the Holborn Restaurant, Crown Room, on Friday, October 21st, at 6.30 (for 7). Mr. C. C. Paterson, O.B.E., &c., the president, will be in the chair. It may be remembered that this event was to have taken place on April 15th last, but had to be postponed owing to the threatened transport strike.

Fire Extinction.—Writing to the *Electrical World* of August 20th, Mr. C. T. Sinclair discusses the methods available for extinguishing fires in transformers and oil switches. As the result of investigation by the Pennsylvania Water and Power Co., it was concluded that for transformer fires the "soda" extinguisher was very satisfactory, short pipes being run to the opposite ends of each transformer, in the ends of which the nozzles of the extinguishers were inserted. The transformer should be electrically dead before the soda is applied. In the case of oil switches, if the fire is in the tops of the pots only, carbon tetrachloride can be used. If this fails, the switch must be made dead; sand serves to extinguish any blaze in the bottom of the compartment, and then carbon tetrachloride will usually be effective in the tops of the pots. If this does not answer, soda may be used, but first all apparatus within reach of the jet must be made dead—which may mean half the plant. The personnel should be specially trained to fire extinction.

In the course of the tests, four substances were tested, namely: Carbon tetrachloride; bicarbonate of soda and sulphuric acid (referred to above as "soda"), a carbon dioxide and water extinguisher; water; and "Foamite," a form of carbon dioxide extinguisher. All these were quickly effective. Actual switches and transformers were set on fire for the purposes of the tests. For external fires, sand and damp sawdust were equally effective.

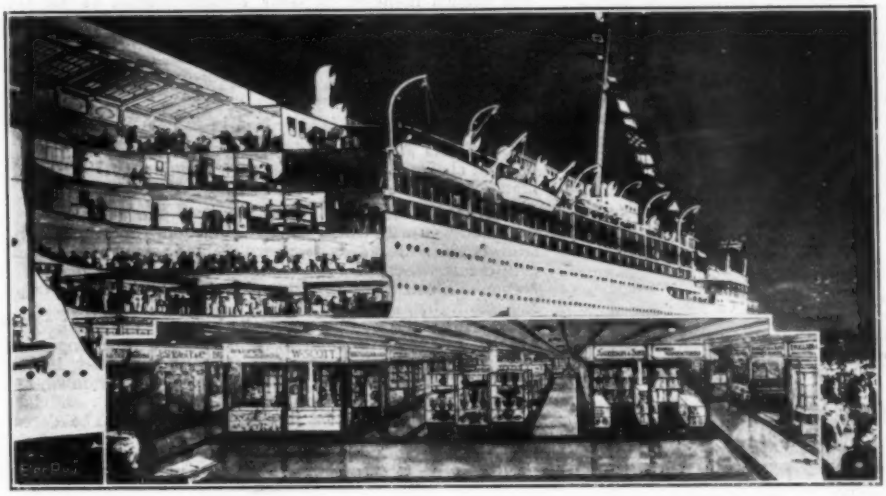
It was found by test with pressures up to 80,000 V that a "soda" jet was non-conducting beyond about 44 inches from the nozzle; at a less distance it became a fairly good conductor, rendering the operator liable to shock. Hence in using "soda" or Foamite the apparatus should first be made dead, not only to ensure the safety of the operator, but also to prevent flash-overs. The same applies to the use of sand and sawdust, and great care should be taken that neither of these be permitted to fall into the blazing oil pots, as the operator may be severely burned and the intensity of the fire increased.

It is especially important to note that carbon tetrachloride, used in poorly ventilated positions, is dangerous to life; under certain conditions deadly gases such as phosgene, chlorine, &c., are generated, and a number of deaths have occurred for this reason. The liquid is valuable for extinguishing small fires, but care should be taken in its use.

An Australian Test House.—A Scientific Test House, the first of its kind in Australia, has been established in Sydney, by Mr. H. H. Scotland, B.Sc. (London), A.M.I.C.E., a New Zealander by birth, having had experience in America as well as England. The programme laid down by the founder of this new establishment embraces general scientific investigation, such as ascertainment of the calorific values of fuels, testing of steam and internal combustion engines, calibration of electrical instruments, and the heat treatment of steel. Furnaces are being put in for the treatment of high-speed steel, for case-hardening and the hardening and tempering of steels generally for traders. Later on it is intended to provide for special equipment for the mechanical testing of steel and other metals, also the testing of electrical machinery. —*Indian Textile Journal.*

Correction.—In the advertisement of Messrs. Simplex Conduits, Ltd., appearing on p. 47 (Supplement) of our last issue in the second paragraph, line two, by a printer's error the word "Simplex" was given in place of "simple."

A Floating Exhibition.—With further reference to the floating exhibition ship *British Industry*, which it is proposed to send on a tour of the chief ports of the world in two years' time, as has been explained in our columns recently, the accompanying illustration is intended to give some indication of what the vessel will be like. The venture is likely to be of great benefit to the export trade of the British Empire, and should make a strong appeal to merchants and manufacturers in this country. The idea, of course, is not new, as it has been tried recently by the U.S.A., Italy and Japan with a considerable amount of success. The innovation and essence of the present enterprise is that the ship will be especially built for the purpose of displaying an exhibition of manufactured goods to the best advantage, and at the same time afford ample accommodation for a large number of trade representatives on board. Arrangements will be made for forwarding fresh samples to meet the vessel at any particular spot so as to keep the exhibition both up to date and appropriate to the countries visited. The main advantages of the project are so obvious that it would be superfluous to reiterate them; the commercial traveller carrying his samples from town to town covers relatively little ground in a long period of time and at a maximum cost and inconvenience; the principle can be extended by co-operation, and that is the object of the *British Industry*. All the plans have been drawn up and arrangements completed; it only remains for British manufacturers to give the promoters of the scheme their hearty support. The object is a worthy one, and we commend it to all. "Trade follows the Flag."



The British Trade Ship: Illustrative Sections.

Engineering Wages.—The War Bonus Question.—The *Daily Telegraph* states that the question of the abolition of the Ministry of Munitions war bonus in the engineering trades was considered at a preliminary conference of the unions involved, at the Central Hall, Westminster, on Tuesday.

The official termination of the war, the employers contend, automatically brought to an end the bonuses of 12½ per cent. for time-workers and 7½ per cent. for piece-workers. It was, however, agreed, when the cut of 6s. per week in wages was arranged two months ago, that the withdrawal of the war bonuses should be discussed between the employers and the unions this month, having regard to the present position and prospects of the industry. Tuesday's meeting of the unions was for the purpose of formulating a policy to place before the employers. The unions represented were the Federation of Engineering and Shipbuilding Trades, the Amalgamated Engineering Union, the Foundry Workers, and the National Federation of General Workers, over a million skilled and unskilled workers being concerned throughout the country. The negotiating committee which acted on the occasion of the recent wage reductions was reappointed, and this committee was to meet a committee of the employers on Wednesday.

Service Notes.—Lieut. A. A. Davis, Lieut. D. E. Ross, and Lieut. W. A. Gladwin, Tyne Electrical Engineers, have been transferred to the regimental list of the Territorial Reserve of Officers. Lieut. H. Hutchinson and Lieut. W. Dixon, of the same electrical corps, resign their commissions and retain their rank.

Survivors of the Battle of Jutland, who would be willing to "speak to" the film when it is exhibited, are invited to communicate with Ideal Films, Ltd., 76, Wardour Street, W.1, giving their rank and the names of their ships.

The Midland Electrical Engineers' Ball.—The committee has decided to hold the Midland Electrical Engineers' Ball this season at the Grosvenor Suite, Grand Hotel, Birmingham, on Friday, November 25th. Mr. R. A. Chattock will again act as chairman, and Messrs. G. J. Bish, Vickers House, Loveday Street, Birmingham, and W. Y. Anderson, 14, Dale End, Birmingham, as joint hon. secretaries. Tickets are one guinea each, and may be obtained from any of the gentlemen named above. Joyce's London Band will be in attendance, personally conducted by Mr. Archibald Joyce.

Hydro-electric Works in Austria.—As was recently mentioned, a company has been formed in Vienna for the purpose of constructing hydro-electric works for supplementing the supply of electricity in the Austrian capital. Despite many efforts it has been found impossible to induce foreign capitalists to finance proposed works on account of the depreciation of the krone, the change in the international coal situation, and the absolute impossibility of obtaining any return on invested capital in the event of the krone appreciating. Under these circumstances the Vienna banks, under the leadership of the Escompte Gesellschaft, recently reached the conclusion that a risk of installing one horse-power at a cost of 100,000 kr., which in former peace times cost 1,000 kr., could only be borne by those who were able to determine the price of energy as a monopoly, which is the case with the municipal authorities of Vienna. The steam generating stations of the latter already produce 320,000,000 kWh per annum, and are unable to meet the demands of the area of the city. Under these circumstances eleven banks in Vienna have co-operated with the Vienna municipal authorities in the formation of the Wasserkraft Werke A.G. (W.A.G.), with a share capital of 500,000,000 kr., of which half has been taken over by the banks and the other half by the City of Vienna. The first instalment of the works, which is to be begun in November, comprises the utilisation of the water power of the Ybbs and of the Lunz-Kienberg-Gamming "water main," and is to be completed in July, 1926. It is intended to raise the capital cost of construction amounting to 3,600,000,000 kr. by the issue of bonds having a mortgage right on the new works, and the interest and redemption charges are to be guaranteed by the City of Vienna. On the completion of the works the City Council will operate them, and they will become the property of the city free of charge at the end of 50 years. The financial relations between the city authorities and the W.A.G. make provision for the payment of the interest on and redemption of the latter's share capital.

INSTITUTION NOTES.

Institute of Transport.—The postponed second dinner of the Institute is to be held at the Hotel Cecil on October 10th. The hon. secretary is Mr. H. E. Blain, C.B.E., 2 and 3, The Sanctuary, Westminster, S.W.1.

Municipal Tramways Association (Inc.).—On Wednesday next the annual conference will be opened at the Technical Institute, Salford, under the presidency of Mr. G. W. Holford, general manager of the Salford Tramways. The Mayor of Salford and the Tramways Committee will receive the Association at 10.30 a.m., and the president will deliver his address at 11 o'clock, after which Mr. J. M. McElroy will read a paper on "Some Phases of Tramway Development in the Past, and the Outlook." Luncheon in the Town Hall, Pendleton, at the invitation of the Tramways Committee, will follow at 1 p.m., and in the afternoon a paper will be read by Mr. J. B. Hamilton, C.B.E., on "The Operation of Tramway and Bus Undertakings under Statutory Powers." In the evening the Mayor will hold a conversazione at the Salford Town Hall. On Thursday there will be a meeting of the Managers' section, and a paper by Mr. W. Chamberlain on "Permanent Way—Public Road—Maintenance." Luncheon will be provided at the Manchester Town Hall by the Manchester City Tramways Committee, and in the afternoon the annual general meeting will take place. The annual dinner will be held at the Grand Hotel, Manchester, on Thursday evening; Mr. Arthur Neal, M.P., will be the guest of the Association. On Friday there will be an excursion to Chester, with entertainment on the river at the invitation of the Mayor, the Sheriff, and the Chairman of the Tramways Committee. Special arrangements will be made for the entertainment of the ladies during the conference.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the comercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Sir Philip Dawson, who at last week's by-election at Lewisham was elected M.P., is well known to electrical engineers by reason of his lengthy connection with the electrical industry, especially on its traction and power sides in consultative capacities, also through his valuable work as the author of books on the subject of electric traction in which he has long been a recognised authority. In the early days of equipment of electric tramways in this country on the overhead trolley system he played a leading part at Bristol and in many other places. In more recent years he has been responsible for the electrification of the suburban lines of the London, Brighton & South Coast Railway. He is a member of the Electrification of Railways Advisory Committee (of the Ministry of Transport) and of the Water Power Resources Committee (of the Board of Trade), and is vice-president of the Belgian Commission for Electrification of Railways. The services rendered by Sir Philip in connection with the war and as a member of the Disposals Board of the Ministry of Munitions were described in the Electrical Review for June 18th, 1920, p. 788. It would take a good deal of our space merely to name the host of local clubs, associations, and other organisations with which he holds office either as president, chairman, or in some other capacity; only a man of such boundless energy as Sir Philip possesses could

Photo by] [*Everitt.*

Sir Philip Dawson, M.P.

hope to carry out all his engagements of this kind in addition to his engineering work as a partner in the firm of Kincaid, Waller, Manville & Dawson, of Westminster, and still survive. Now to all of these he has added the heavier claims devolving upon a Member of Parliament, but we have every confidence that his wide experience of public affairs, his intimate acquaintance with the professional and industrial interests of engineering, and his striking and vivacious personality will enable him worthily to contribute to the well-being of the Empire in these critical days.

Last week Mr. Joseph Savage, power station superintendent at Paisley, was presented by the staff and employés of the Corporation electricity department with a barometer and Mrs. Savage with a wristlet watch. The presentation was made by Mr. W. Blair Smith, the chief engineer and manager. Mr. Savage is taking up a more important position with the St. Helens Corporation electricity department.

Mr. J. W. Rodger, A.M.I.E.E., of Messrs. Ferranti, Ltd., Hollinwood (transformer department), was married on 14th inst. to Miss Kitty Rhodes, of Preston. At the reception the firm was represented by Mr. V. de Ferranti and Mr. Gardner.

Mr. J. W. Hame, city electrical engineer and tramways manager at York, who has been on sick leave in Devonshire for some months past and unable to attend fully to duty, tendered his resignation last week, and under the circumstances the Electricity and Tramways Committee felt they had no alternative but to accept it. Mr. Hame served his apprenticeship with Messrs. Ronald Scott & Co., London, and joined the St. James' & Pall Mall Electric Light Co. in 1894, becoming assistant engineer at the works of the Leyton District Council three years later. He left Leyton for service with the Cork Electric Tramways Co., and subsequently became chief assistant engineer to the Wigan Corporation Electric Light and Tramways Department. In May, 1902, he became chief assistant at York, and in 1906 he was appointed chief electrical engineer. He has been closely associated with the construction of the new power station at Linton Locks in recent months.

Messrs. Johnson & Phillips, Ltd., Charlton, have appointed Capt. H. J. Groves-Webb, A.M.I.E.E., to be the engineer and branch manager of their London branch at 12, Union Court, E.C. 2, in succession to the late Mr. A. R. Connal. Capt. Groves-Webb was appointed chief assistant engineer at the London branch in August, 1919, on his return from France, and enters upon his new duties immediately.

The marriage took place at Whitehaven Wesleyan Church on September 14th, of Mr. T. D. Spark, electrical engineer to the Whitehaven Colliery Co., Ltd., and Miss M. F. Bell.

The Times states that Mr. Alfred Shepherd has been appointed chairman and Mr. George Balfour, M.P., vice-chairman of the Lancashire Electric Light & Power Co., Ltd.

Obituary.—Mr. L. B. Schlesinger.—We regret to record the sudden death which occurred on September 2nd in Scotland of Mr. Leonard Bernhard Schlesinger. The deceased gentleman, who was 64 years of age, was chairman of the National Electric Construction Co., Ltd., and of the Torquay, Musselburgh, and other electric tramway companies.

Mr. A. A. Day.—We regret to learn of the death of Mr. Arthur A. Day, M.I.E.E., formerly electrical engineer at Bolton, he being elected to that position in August, 1900. In 1904 he took over the management of the tramways. In September, 1912, Mr. Day's health broke down, and he resigned both positions in the following June. The deceased gentleman was 57 years of age.

NEW COMPANIES REGISTERED.

B. Barnett (Electrical Engineers), Ltd. (176,774).—Private company. Registered September 14th. Capital, £1,000 in £1 shares. To acquire the business of an electrical and general engineer carried on by B. Barnett, at 104, Whitechapel Road, E. The subscribers (each with one share) are: B. Barnett, 100, Bethune Road, Stamford Hill, N.16, electrical engineer; B. Agambar, 1, Rose Cottages, Wells Road, Sydenham, S.E., electrical engineer; T. H. Hammond, 33, Upper Park Road, Haverstock Hill, N.W.3, solicitor's clerk. B. Barnett signs as director. Registered office: 104, Whitechapel Road, E.

Visco Engineering Co., Ltd. (176,772).—Private company. Registered September 13th. Capital, £1,000 in £1 shares (100 preference and 900 ordinary). To carry on the business of founders, electrical and mechanical engineers, electricians, metal workers, &c. The first directors are: Frances Truscott, 131, Tyneham Road, Battersea, S.W.11, clerk; G. Defries, 37, Walbrook, E.C., agent and merchant. Registered office: 21, Bedford Road, W.C.1.

Resisto Electric Wire & Tape Co., Ltd. (176,804).—Private company. Registered September 15th. Capital, £500 in £1 shares. To carry on the business of manufacturers of and dealers in alloy wires and tapes, electrical engineers, wire drawers, engineers, annealers and heat treatment specialists, &c. The subscribers (each with one share) are: H. Kemp, Crofton Avenue, Sheffield, secretary; and G. Mason, 60, Sandford Grove Road, Sheffield, manager. The first directors are to be appointed by the company in general meeting. Qualification £1. Solicitor: W. Irwin Mitchell, 53, Queen Street, Sheffield. Registered office: Burton Road, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Arnott & Harrison, Ltd.—Satisfaction to the extent of £750 (being amount issued) on September 2nd, 1915, of debentures dated October 23rd, 1912, and January 31st, 1913, forming part of an authorised issue of £1,000.

Electrolite, Ltd.—Charge on company's property, present and future, including uncalled capital, dated August 23rd, 1921, to secure advances made and to be made and other moneys which the chargee may be called upon to pay under various guarantees (subject to existing debentures for £2,000). Holder: F. Durrant, 21, Russell Hill, Purley, Surrey.

Advance Engineering Co., Ltd.—Debentures dated August 17th, 1921, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Wilson-Wolf Engineering Co., Ltd.—Satisfaction in full on August 26th, 1921, of mortgage dated December 30th, 1920, securing all moneys due or to become due from company to bankers.

Ramsden Green, Ltd.—Particulars of £500 debentures authorised August 27th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

General Electric Co., Ltd. (67,307).—Return dated August 4th, 1921. Capital, £6,000,000 in 1,800,000 "A" preference, 1,800,000 "B" preference, and 2,400,000 ordinary shares, all of £1 each. 1,705,790 "A" preference, 1,622,891 "B" preference, and 2,111,975 ordinary shares taken up £4,418,830 paid in cash on 1,481,330 "A" preference, 1,000,000 "B" preference, and 1,337,500 ordinary. £1,021,896 credited as paid on 224,460 "A" preference, 22,891 "B" preference, and 774,475 ordinary. Mortgages and charges outstanding, £3,500,000.

CITY NOTES.

Southern Brazil Electric Co., Ltd.

Mr. E. H. Tootal presided at the annual meeting, held in London, on September 15th. The directors' report then presented stated that during the year 1920 the company acquired further interests in Empreza de Melhoramentos Urbanos (Piracicaba) and Companhia Mogyana de Luz e Força. The revenue from these undertakings is proceeding on a satisfactory scale. For the purpose of repaying loans outstanding and for acquiring the additional interests in Brazil the directors had issued the remaining £80,000 of debentures and had further issued 8 per cent. 10-year notes for £174,500. The profit and loss account showed a debit balance to be carried forward of £37,850. The adverse result was due to the heavy losses incurred through the fall in Brazilian exchange and to increased charges for interest on loans, &c. The chairman, after referring to the heavy loss on working and the depreciation of currency in Brazil which had caused the sterling value of the company's revenue to suffer in consequence, said that there had been an increase in the currency earnings, which was very satisfactory considering the adverse conditions of trade in Brazil. The several undertakings with which they were concerned were all carrying on their services to the satisfaction of the local consumers, both public and private, new connections were being made in the coffee-growing districts, and the fresh interests acquired held out good prospects of increasing revenue. Cables to hand from Brazil indicated that the worst of the crisis was now over, and that conditions tended to improve. Health conditions had continued good, and the members of their own staff and the staffs of the subsidiary companies had all carried out their work in the most efficient manner. The speaker welcomed at the meeting the company's Sao Paulo colleague, Mr. Byington, who so ably directed and supervised their Brazilian business.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under Rule 148a :—

Newcastle-upon-Tyne Electric Supply Co.—£633,109 4½ per cent. first mortgage debenture stock, redeemable 1939, scrip certificates; and £100,000 5 per cent. second mortgage debenture stock, redeemable 1949, scrip certificates.

The following have been ordered to be officially quoted :—

Victoria Falls & Transvaal Power Co.—£1,932,170 5 per cent. first mortgage debentures (within Nos. A1 to A12,375, B1 to B13,600, and C1 to C20,000).

Prospectus.—*Lancashire Electric Light & Power Co., Ltd.*—An issue of £400,000 7½ per cent. prior lien debenture stock at 95 per cent. (repayable at 105 per cent.) has been offered for subscription this week. The proceeds are required for the discharge of the balance of commitments incurred in the extension of the power company's generating station, distributing mains, and substation equipment, the cost of which is approximately £850,000. The estimated net earnings available for interest, reserves, and dividends for 1921, based on the actual profits to September and estimated to the end of the year are £92,000, against £47,356 for 1920. The profit for the latter year was seriously affected by the delay in obtaining and installing the new plant ordered early in 1919. The list was to close yesterday, but as a matter of fact, so ready was the response, that it actually closed on the day the prospectus was advertised.

Direct West India Cable Co.—Dividend of 3 per cent., free of tax, for the half-year, making 6 per cent. for the year. There has been expended on repairs £6,388, and £96,051 is carried forward, subject to E.P.D. and corporation profits tax.

Halifax & Bermudas Cable Co.—Dividend of 3 per cent., free of tax, for the half-year, making 6 per cent. for the year. There has been expended on repairs £2,504, and £61,567 is carried forward subject to E.P.D. and corporation profits tax.

General Electric Co. (U.S.A.).—A dividend of $2 per share on the capital stock is announced.

British Insulated & Helsby Cables, Ltd.—An interim dividend of 9d. per share, less tax, on the ordinary shares is announced.

Dumbarton Burgh & County Tramways Co.—A dividend of 3 per cent. actual on the preference shares is announced. There is no dividend on the ordinary shares.

British Electric Transformer Co., Ltd.—The profit for the half-year ended June was £51,983, against £35,344 for the same period in 1920.

Midland Electric Corporation for Power Distribution.—A dividend of 4 per cent. for the half-year ended June is announced.

South London Electric Supply Corporation, Ltd.—An interim dividend on the ordinary shares of 5 per cent. per annum, less tax, is announced for the half-year.

Manila Electric Railroad & Lighting Corporation.—A dividend of 1½ per cent. on the common stock for the September quarter is announced.

Shawinigan Water & Power Co.—A dividend of $1¼ per share on the common stock is announced.

STOCKS AND SHARES.

Tuesday Evening.

Towards the end of last week an impression became current that the Bank Rate was on the point of being lowered, and by reason of this expectation, prices of war stocks, together with those of other investment securities, were promptly advanced. The Bank, however, retained its rate at 5½ per cent., and money inclined to stiffen in the early part of this week. Other circumstances conspire against active business, either amongst investment or speculative issues. Foreign exchanges have again fallen into a condition of chaos, and at the moment of writing, the Irish situation still looks unpromising. People are chary of entering upon Stock Exchange engagements; they confine their attention to investment stocks pure and simple.

Amongst these, the electric lighting list is being studied as a useful field for securities likely to improve in price. County of London ordinary changed hands as high as 9 1/16 xd. Kensington are ¼ up; so are Westminsters and Metropolitans. Where prices have not moved, it has been, as a rule, because there was no stock to supply buyers who declined to pay more than the current quotations. If a man offers the higher of the two prices quoted in the Stock Exchange Official List, and fails to obtain the offer even at that figure, he can insist upon the price being put up. The disadvantage of doing this is obvious enough. Nobody wants to pay more than he is obliged to do, and there is always the hope that somebody may require to sell, either as an executor or for other reasons, so that quotations are not advanced, in such investment shares as those of the electric light section, until it becomes really necessary. This is the reason why there are not more rises in the lists week by week.

The movements in electric railway stocks are irregular. Central London ordinary assented has gone up to 48¼, Underground Income Bonds to 76½, showing rises of 1 in each case. The latter company's ordinary and the "A" shares are both lower, and Metropolitans went back to 24. The Great Northern Railway has given notice to the local authorities, through which its lines run, of an appeal against their assessments. If this should prove successful, and any substantial reduction should be made in rates, the result would rejoice the heart of every railway stockholder in the land, and the progress of the Great Northern's appeal will be watched with lively attention. The company seems to have undertaken an expansive and lengthy job, and it remains to be seen whether the results will justify the courageous effort.

The Lancashire Electric Light & Power Co. has this week offered £400,000 7½ per cent. prior-lien debenture stock at 95. The security was shown in the prospectus to be well-covered, and the subscription lists, which opened at nine o'clock on Monday, were closed 2½ hours later, striking testimony to the willingness of money to take up sound security offered on tempting terms. Amongst the new issue prices, the feature is the way in which Shropshire 7½ per cent. debenture has moved up to 1½ premium on its issue price of 97. North Metropolitan and Metropolitan Electric new debentures have both been up to 9 premium, a price which evidently tempted a little stock to market, because the quotations receded to 8¾ premium, still leaving them with a small improvement on the week. General Electric new debenture is quoted 96¼. Several new issues are said to be coming in the near future, and with the conclusion of the holiday season, promoters are beginning to get busy again.

The Midland Electric Corporation for Power Distribution is to pay an interim dividend of 4 per cent. on its ordinary shares, the same rate as that paid 12 months ago, but the capital has been largely increased in the meantime, and the money required to pay the dividend is almost double that distributed in September, 1920. The ordinary shares are quoted at 20s., the 7 per cent. preference at 16s. 9d., and the 5 per cent. 1st mortgage debenture stock at 78½, business being done in the last-named at this price on Monday. Another dividend which is maintained, is the 6 per cent. of the British Electric Transformer, the company announcing its profit as £52,000, an increase of £17,000 as compared with this time last year. The 7 per cent. cumulative preference shares stand at 17s. and the ordinary changed hands this week at £1. British Aluminium dropped 1s 9d. to 15s. 9d. on a reduction to 2½ per cent.—against the usual 4 per cent.—in the interim dividend. In the circumstances, it is difficult to say the yield on the shares.

Anglo-American Telegraph preferred has advanced to 87. Chili Telephones are better at 5¼, and the rest of the cable group is marking time. Great Northerns at 24¾ parted with some of their recent improvement. Marconis have gone back to 1 13/16, but Radio Corporation shares of both sorts, common and preferred, have risen a shilling or so to 10s. 3d. The

dividend announcement in respect of Radio preferred, which was expected as long ago as last May, is still wanting. The other Marconi descriptions are inclined to follow the heaviness shown by the shares of the parent company.

German marks have been changing hands on the basis of twenty to the shilling, and this is regarded as an incentive to German trade. The German manufacturer, who sells his goods over here for sterling, converts the latter into marks, and pays wages in his own country in the debased currency. This is all very well, of course, as long as he does not go outside his own country to buy anything. When he does that, the position is reversed, but so long as he can sell his own country's goods, the low exchange is all in his favour. Nevertheless, electrical manufacturing shares are firm, on the assumption that the safeguarding of Industries Bill will prevent, to some extent, the possibility of the country being made the dumping ground of cheap German products. General Electrics retain their price at 20s. Siemens keep very steady at 23s. 1½d., and Metropolitan-Vickers hold their rise at 36s. 3d. The iron and steel market, however, is on the dull side. Babcock & Wilcox eased off to 2⅜, to rally later to 2 17/16. Vickers and Armstrongs are languid. Vickers tax-free preference drooped to 13s. 9d. Rubber shares are better on the August Board of Trade Returns reflecting an increased demand for rubber from America and Central Europe.

Brazil Tractions slipped back to 29, and British Columbia Railway stocks are heavy. Canadian General Electric preferred weakened to 102½. Rangoon Electric Tramways 6 per cent. preference at 3¼ are 5s. down. Mexican Utility bonds and shares are being neglected. Foreign sales of Puebla Tramway Light and Power common shares, led to the price giving way to 5¼. Other foreign issues remain uninteresting.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price Sept. 20, 1921.	Rise or fall.	Yield. £ s. d.
Home Electricity Companies.					
Brompton Ordinary	12	12	6⅞	—	£9 8 2
Charing Cross Ordinary	7	8	4½	—	9 8 4
do. do. do. 4½ Pref.	4½	4½	8⅞	—	7 4 4
Chelsea	4	5	5⅛xd	—	9 4 8
City of London	13	14	11xd	—	10 9 0
do. do. 6 per cent. Pref.	6	6	11/6	—	6 17 2
County of London	8	8	9xd	—	8 17 10
do. do. 6 per cent. Pref.	6	6	6¼	—	7 7 4
Kensington Ordinary	7	9	6½	+ ¼	10 11 10
London Electric	3¼	3¼	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	7⅜	—	16 9 0
Metropolitan	6	7	4⅜	+ ⅛	8 9 8
do. 4½ per cent. Pref.	4½	4½	2⅛	+⅛	7 13 2
St. James' and Pall Mall	12	12	6¼	—	9 4 8
South London	6	7	3⅜	—	10 18 2
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6¼	+ ¼	8 10 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	57	+ 1	6 18 0
do. Def.	1½	1½	17½	—	8 14 2
Chile Telephone	6	6	5⅜	+ ¼	6 11 7
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16½	—	6 1 0
Eastern Tel. Ord.	10	10	16¾	—	6 2 4
Globe Tel. and T. Ord.	10	10	16½	—	6 1 0
do. do. Pref.	8	8	13½	—	6 6 4
Great Northern Tel.	22	24	24½	— ½	9 14 0
Indo-European	10	10	10	—	8 6 8
Marconi	25	15	1⅛	—⅛	8 5 6
Oriental Telephone Ord.	19	19	2⅛	—	*6 16 8
United R. Plate Tel.	8	8	6	—	*6 13 4
West India and Panama	Nil	Nil	6/8	—	Nil.
Western Telegraph	10	10	10½	—	*6 1 2
Home Rails.					
Central London Ord. Assented	4	4	48½	+ 1	8 5 0
Metropolitan	1½	1½	24	— 1	6 5 0
do. District	Nil	Nil	17	—	Nil
Underground Electric Ordinary	Nil	Nil	2	— ½	Nil
do. do. "A"	Nil	Nil	5/-	—6d.	Nil
do. do. Income	4	2	76½	+1	*3 18 5
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	6½	12½	97	—	10 0 0
do. do. 2nd Pref.	Nil	6½	32	—	10 0 0
do. do. 5 % Deb.	5	5	68¾	—	7 17 0
Brazil Tractions	Nil	Nil	29	—1½	Nil
British Columbia Elec. Ry. Ptge.	5	5	60	—	*8 6 8
do. do. Preferred	5	9⅜	54½	—1	*8 12 2
do. do. Deferred	3	12½	55	—1	*11 5 2
do. do. Deb.	4½	4½	68¼xd	—	7 5 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	69	+1	—
do. 6 per cent. Bonds	Nil	Nil	25	—	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	16½	—1	Nil
do. 1st Bonds	Nil	5	48½	—1	10 6 0
Manufacturing Companies.					
Babcock & Wilcox	15	15	2⅞	—	6 11 2
British Aluminium Ord.	10	10	15/9	—1/9	—
British Insulated Ord.	15	15	1⅝	—	9 12 0
Callenders	15	15	1⅞	—	10 8 8
" 6½ Pref.	6½	6½	18/9	—	6 19 8
Crompton Ord.	10	10	14/6	—	13 15 10
Edison-Swan	10	—	7/8	—	—
do. do. 5 per cent. Deb.	5	5	68	—	7 7 1
Electric Construction	10	10	16/9	—	11 18 10
English Electric	8	8	10/6	6d.	15 4 8
Do. Pref.	6	6	14/-	—	8 11 6
Gen. Elec. Pref.	6½	6½	17/9	+3d.	7 6 6
do. Ord.	10	10	20/-	—	10 0 0
Henley	15	15	1⅝	—	10 5 0
do. 4½ Pref.	4½	4½	6⅞	—	6 16 6
India-Rubber	10	—	½	—	—
Met.-Vickers Pref.	8	8	11⅜	—	8 16 10
Siemens Ord.	10	10	1⅛	—	*3 13 2
Telegraph Con.	20	20	21½	+ ¼	*5 11 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7¾d.	¼d. dec.
a Ammoniac Sal	per ton	£65	..
a Ammonia, Muriate (large crystal)	"	£58	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£31	..
a Copper Sulphate	"	£61	..
a Potash, Chlorate	per lb.	6d.	..
a " Perchlorate	"	6d.	..
a Shellac	per cwt.	£15 10s.	20/- inc.
a Sulphur, Sublimed Flowers	"	£16	..
a " Lump	"	£15	..
a Soda, Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	7½d.	1d. inc.
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£90 to £275	..
c Brass (rolled metal 3" to 12" basis)	per lb.	10⅜d.	..
c " Tubes (solid drawn)	"	1/0½ to 1/0¾	..
c " Wire, basis	"	11¼d.	..
c Copper Tubes (solid drawn)	"	1/2½	..
c " Bars (best selected)	per ton	£103	..
c " Sheet	"	£103	..
c " Rod	"	£103	..
d " (Electrolytic) Bars	"	£74	10/- inc.
d " " Sheets	"	£145 10s.	..
d " " Wire Rods	"	£90	10/- inc.
d " " H.C. Wire	per lb.	11 7/8d.	⅛d. inc.
f Ebonite Rod	"	5/6	..
f " Sheet	"	5/-	..
g German Silver Wire	"	2/9	..
h Gutta-percha, fine	"	12/6	1/1 dec.
h India-rubber, Para fine	"	1/0½	½d. dec.
j Iron Pig (Cleveland Warrants)	per ton	Nom.	..
j " Wire, galv. No. 8, P.O. qual.	"	£30	..
g Lead, English Pig	"	£24	5/- dec.
g Mercury	per bot.	£9 15s. to £10	5/- dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	..
e " " " medium	"	4/- to 8/-	..
e " " " large	"	10/- to 20/- & up	..
p Phosphor Bronze, plain castings	"	1/4 to 1/9	..
p " " rolled bars and rods	"	2/1 to 2/6	..
p " " rolled strip & sheet	"	2/3 to 2/7	..
d Silicium Bronze Wire	per lb.	1/3¾	..
r Steel, Magnet, in bars	"	1/8	..
n Tin, Block (English)	per ton	£155	£5 dec.
n " Wire, Nos. 1 to 16	per lb.	3/6	..
p White Anti-friction Metals	per ton	£65 to £275	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons,
p ——
r W. F. Dennis & Co.

A.c. Periodicity in Mills.—In a paper before a recent meeting of the American Iron and Steel Electrical Engineers, and American Institute of Electrical Engineers, Pittsburg, Mr. B. G. Lamme (chief engineer of the Westinghouse Electric & Manufacturing Co.) discussed the growing tendency to adopt 60-cycle in preference to 25-cycle power in connection with the electrical operation of steel mills. He pointed out that much of the heavier steel-mill service was at relatively low speeds with direct-connected motors, on the basis that large, high-speed, high-power gears would not be satisfactory. However, speeds, frequencies, and the economical combination of poles were intimately related. High speed resulted in lower first cost of a machine, but low speed was most in demand in steel-mill work. In the development of induction motors the tendency was towards higher speeds, and 60 cycles presented material advantages. One condition which now lent itself to the use of 60 cycles in steel mills had been the increased use of gearing, thus allowing higher-speed motors. For many kinds of service, gearing was now used where direct connection, a few years ago, was considered to be the only method. In consequence, the speeds of the motors used in steel-mill work would in future average much higher than in earlier practice.—*Iron and Coal Trades Review.*

Gas v. Electricity.—Attitude of Glasgow Assessors.—A remark by the City Assessor at a Glasgow Valuation Court, last week, that he is prepared to assess houses lit by gas at 5 per cent. less than those lit by electricity is being much discussed. A householder, writing in the *Glasgow Herald*, says it would be interesting to have the assessor's reason for this attitude, and goes on to say: "The Corporation advocate the use of electricity on health grounds. They say there are no fumes, dust, dirt, or vitiation of atmosphere. Now the assessor's proposal is a distinct discouragement to those intending to substitute electricity for gas. The writer had intended doing so, but the assessor's pronouncement counsels caution. I have no doubt many others are of like mind, and, as a consequence, men who would be employed installing electricity are idle."

THE BRITISH ASSOCIATION.—III.

On Saturday and Sunday, September 10th and 11th, excursions and church services were arranged. The coach proprietors put on extra services, but the cold and wet weather deterred many, and most of the special excursions were poorly patronised.

In spite of great sectional activity on Monday morning, there was not a great deal of matter of direct electrical interest, although there were several allied subjects which may be mentioned.

Section A (Mathematical and Physical Science) had a short paper by Prof. C. G. Barkla, F.R.S., on "The Energy of X-radiation." This was necessarily largely of a mathematical and diagrammatic nature. The quantitative study of the energy transformations occurring when X-radiation passes through matter is of first importance in any consideration of rival theories of radiation, and it is of the greatest interest to summarise our knowledge of these measurements and study their significance. This Prof. Barkla endeavoured to do. He pointed out that processes of radiation and absorption may be, and are, continuous and without limiting condition. They are governed by chemical laws. But radiation also takes place from atoms under certain critical conditions, possibly from atoms in an abnormal or, at any rate, exceptional, state. Definite changes then occur, and a definite amount of energy is thereby liberated—a quantum. The corresponding absorption is not then a direct effect on electrons in a field, but is an atomic phenomenon. We shall, however, said Prof. Barkla, have to learn much more of the atom before we can picture the process.

In Section C (Geology) a lively and practical discussion took place concerning the search for oil in Scotland, a subject not without some interest to power producers. It seems, however, that the hopes of a home oil industry have to all intents and purposes vanished. Section C also discussed with Section G the proposal to build a mid-Scotland canal, but here also the "noes" were prominent. Section F (Economics) continued its discussion of economic and industrial questions. Particular attention may be called to a paper by Dr. Mary T. Rankin. It contained a review of the legislation regarding so-called compulsory arbitration, which most of those engaged in business know all about, and put forward one or two more or less Utopian ideas which were severely, not to say rudely, handled in the discussion.

Tuesday, September 13th, was the day of electrical interest in Section G, four papers being presented, which will be given in abstract later. Unfortunately, Mr. Sydney B. Donkin was prevented by illness from reading his paper on the new electricity supply station of the Edinburgh Corporation for supply in bulk to the city and to the Lothians, and it was taken as read in his absence. Dr. S. P. Smith's paper, compiled from notes supplied by no fewer than 21 firms, followed, after which came Mr. John Scott-Taggart's paper describing two new negative resistance devices for use in wireless telegraphy. On neither of these three papers was there any discussion, and we got to Dr. T. F. Wall's paper on "The Long-distance Transmission of Electrical Energy Generated by Means of Tidal Power," which dealt with another aspect of the much discussed and now, temporarily, at any rate, abandoned Severn scheme of the Ministry of Transport. The Report of the Committee on Complex Stresses was submitted, and in the afternoon there was a visit to Rosyth. During the reading of Mr. Scott-Taggart's paper messages were received from the Eiffel Tower and the Admiralty station at Aberdeen, but there was a good deal of interference by local stations.

There is not much calling for reference in the other Sections. A great gathering assembled for a joint discussion by Sections A, C, D, and K, on the age of the earth.

In Section B (Chemistry), Dr. J. S. Owens gave a further account of the experiments he is carrying out for the Advisory Committee on Atmospheric Pollution, all of which tend to show the need for restricting in some way the use of raw coal in factories and for domestic purposes. Dr. Owens measured the dust in the air of Edinburgh during the meeting, and found it more unclean than in London, a fact which was given due prominence in the local papers.

The Fuel Economy Committee of the B.A. is attached to Section B, but this year no report was actually submitted. As a matter of fact, a short one is in existence which relates that no work has been done during the past year owing to the disturbed industrial conditions and the unfortunate illness of the chairman (Prof. W. A. Bone). The Committee asks for reappointment to complete the programme laid down in its third report, and indicates its intention to bring oil within the ambit of its future deliberations.

In Section F (Economics) a paper on Trusts was read by Prof. D. H. Macgregor, to which we may have occasion to refer later. It reviewed the development of the Trust in relation to large and small businesses, and discussed the criterion of fair competition.

Section I (Physiology) had a discussion on the Physiology of Heavy Muscular Work, which kept rather too much to the purely physiological side, although it brought out many interesting points.

The only Section of interest to our readers that met on Wednesday was G (Engineering), when papers on air lift pumps were read by Dr. J. S. Owens; "Modern High-speed Centrifugal Pumps," by Dr. S. F. Barclay (of Mather & Platt); and "Iron Bacteria in Relation to the Incrustations of Pipes," by Dr. David Ellis.

During the discussion on Dr. Barclay's paper on centrifugal pumps, Prof. F. C. Lea expressed his anxiety to ascertain whether electrically-driven centrifugal pumps were ultimately more economical than steam-driven reciprocating pumps. The author had stated that a set of reciprocating pumps would cost about five times as much to install as an electrically-driven centrifugal set, with which he agreed, but he was not so sure that a centrifugal set would prove to be cheaper in the long run, say, for a year's working, having regard to the present cost of electrical energy for power purposes. The author, however, in his reply, pointed to the additional advantages of the centrifugal set, viz., the smaller space required, and the fact that there was no expenditure on boilers. Again, if a user could be convinced of a saving of something like £10,000 in capital expenditure, it would influence him to a very great extent; the advantages attaching to automatic starting were also of great value. The morning's proceedings were rather rushed, there being, in addition to the papers on the programme, two others contributed by Prof. Timoshensko, of Zagreb, Jugo-Slavia, on dynamic and static stresses in steel rails, and the vibration set up on a bridge by the force of insufficiently balanced wheels passing over it, which were briefly explained by Major Southwell; and another by Mr. J. D. Watson, of Birmingham, on the use of sewage gas for power purposes. Consequently, not very much time was available for discussions, which were reduced almost to mere questions and answers.

On the motion of Prof. Howe, the Recorder of the Section, a vote of thanks was accorded Prof. Gibson for his services in the chair throughout the whole meeting.

The meeting in 1922 will be in Hull, in 1923 in Liverpool, and in response to a request from the General Committees, the Sectional Committees have been considering an invitation from Toronto for 1924, and passing resolutions in favour of accepting it.

The Utilisation of Tidal Power with Special Reference to the Severn Estuary.

By Prof. F. C. Lea, D.Sc., M.Inst.C.E., M.Inst.M.E.

(Abstract.)

Section G.—Engineering.

The range of tides of the River Severn is very much higher than in any other estuary round the coast of Great Britain, and it would appear therefore, with the other conditions being at all equal, that it would be particularly suitable as a source of power production. In the neighbourhood of the junction of the Wye and the Severn, the rise of the spring tides is at times about 50 ft. If such a rise could be depended upon day by day throughout the year, the amount of power available would be very large indeed, and there is every probability that it could be used economically. The neap tides, however, may be as low as 16 ft. The problem is furthermore complicated by the fact that during any month there are two minimum values of the neap tides and two maximum values of the spring tides. However, the times of high and low tides are continuously changing from day to day. If a number of industries could be established in the immediate neighbourhood, the hours of working of which could be adapted to the tides, the problem again would be very much simplified, but that is an ideal condition. The storing of power hydraulically means a large expenditure on civil engineering works and also on hydraulic plant. Turbines would be required in the barrage to generate power at times controlled by the tides. This would have to be used, partly to supply the demand and partly to drive electrically-driven pumps for raising the water to a suitable storage reservoir. It might be quite possible to make centrifugal pumps to raise the water to the impounding reservoir reversible so that they could be utilised as turbines when necessary. To convert the energy of water in the reservoir to electrical energy we may assume for pipe line and turbine an efficiency of 75 per cent., and for the dynamo an efficiency of 95 per cent.; and it is probable that this would again have to be transformed to a higher potential for distribution, so that the efficiency from turbine horse-power at the barrage to distributing station would probably be much less than 45 per cent. and might well be as low as 40 per cent. Assuming a mean efficiency for the turbines at the barrage of 80 per cent., which is probably high, the available horse-power at the distributing station, if all power had to pass through the reservoir, would probably be of the order of from 32 per cent. to 38 per cent. of the available tidal power.

The final answer to the question whether it is worth while installing reversible turbines will have to be made when it is shown that such a turbine can be economical as a turbine and as a pump, and when the capacity of the station has been fixed. How far it will pay to incur expense in connection with high-level reservoirs for storage, and what their capacity should be, can clearly only be determined on reference to the probable cost of all other works. For example, suppose the cost of the barrage is £10,000,000, the total cost of the machinery to give an output of 300,000 h.p. is £18,000,000, and the cost of the reservoir £5,000,000, then if by doubling or even trebling the cost of the reservoir the power can be increased by, say, 50 per cent., the cost of the energy per unit will have been considerably reduced.

Instead of making a high-level reservoir it might be possible to enclose part of the basin by suitable dams, and thus to have a number of basins in which the water could be maintained at levels which could be arranged to give a more continuous constant supply than one basin can give on any day, but it is very doubtful indeed if such a scheme could utilise anything like the same proportion of the available energy as the high-level reservoir scheme; and it is possible that the capital cost per annual unit of power would be much greater. It is possible to utilise both the falling and rising tide to produce power, but it is very doubtful indeed if anything would be gained by this at the Severn. Turbines could be arranged in the barrage whereby both the falling and the rising tide could be utilised without reversing the turbines, or used, if desired, for the falling tide only.

Assuming the turbines to be producing power only when the tide is falling, to arrive at an estimate of the energy available in kilowatt hours (or horse-power hours) per day, it is necessary to know the range of tide for each day and the quantity of water to be taken from the up-stream basin, and it is in addition necessary to fix the mean head under which the turbines work.

It is clear that if there is to be anything like a constant output from the scheme, or if power is to be obtained when the tide is not running, a storage system of some kind is very necessary. Suppose a mean of 250,000 h.p. is obtained from the barrage at neap tide for nine hours per day, say, from 3.30 a.m. to 8, and from 3.45 p.m. to 9.15 at night. If the ordinary demand hours are supposed to be *between* 8 a.m. and 6 p.m., then on this day about 90 per cent. of the energy will have to be obtained from the high-level reservoir. This can, of course, be easily stored on those days when the barrage turbines are giving more than 200,000 h.p., and, provided sufficient pumping plant is installed, the turbines in the barrage that will give about 342,000 h.p. at neap tides, will give the necessary power to drive the pumps.

If suitable storage could be provided, there should be available, assuming for the whole system an average of 50 per cent. efficiency, a mean output of not less than 500,000 h.p. for a 10-hour working day. This capacity will have to be much greater than that which ensures a daily supply corresponding to the neap tide supply. In connection with this it should be clearly recognised that when power has to reach the distributing station by means of the service reservoir, the efficiency is less than 45 per cent., and the more the mean load exceeds the neap tide output the less the overall efficiency. Again, it should not be overlooked that the barrage turbines can only produce power at the will of the tides, and thus at those times of the day when the load is heaviest the barrage turbines may not be at work.

The number of turbines required, if working on a half-tide system, would be from 600 to 900, depending upon the horse-power of turbine, *e.g.*, turbines of 10 ft. and 15 ft. diameter, respectively, have horse-powers, at 17.8 ft. head, of 2,400 and 3,600 respectively. If, however, we work on the system of a range from 6.5 ft. head to 6.5 ft. head and a fall of half a tide, the number of turbines will be only from 400 to 600, depending upon the size of the turbine determined upon.

At neap tides, the total power available is 372,000 h.p. for nine hours per day. The mean head is 9.3 ft., or at neap tides, 481,600 h.p. could be produced for six hours per day on the half-tide system.

If for a mean head of 9.3 ft., each turbine had a horse-power of say, 1,000, then the number of turbines required would be 372,000/1,000=372.

In the half-tide system the number of turbines to give 481,600 h.p. at 8 ft. head would be much greater. So that from this point of view it will be better to work on the variable head system.

The type of turbine to be used at the barrage must almost essentially be the modified Francis turbine, known as the mixed-flow turbine. The guide blades for these can be made fixed or movable. If the guide blades are fixed and the speed varied, the efficiency can probably be kept more constant.

The use of reaction turbines working under a head of 500 ft. or 600 ft. has not been yet developed, but it should be possible. For starting up the pumps, it may be desirable to be able to run the motors beyond the steady speed, and for this reason direct-current motors may have a distinct advantage.

Finally, it would appear from these preliminary calculations, that it should be easily possible to depend upon a minimum mean output per day at the barrage of 2.5×10^8 h.p. hours, without any high-level reservoir, but the horse-power would vary with the variation of the tide. If this could be used at its time of generation, there would be no necessity for an auxiliary reservoir, but it might be necessary to have expensive electrical plant in order to keep a constant potential on the distributing line. The only hope of using the power economically as produced would be at special chemical and metallurgical works where the shifts might perhaps be adapted to the vagaries of the tide. This does not appear to be a very likely possibility.

The Long-distance Transmission of Electrical Energy Generated by Means of Tidal Power.

Section G.—Engineering.

On September 13th, Dr. Wall's paper, abstracted in our last issue, was read, and in the course of the discussion Prof. G. W. O. Howe (Recorder of the Section) said that a great deal of attention had been devoted to the quarter-wave system of working during the last year or two, especially in France. Our knowledge of the transmission of electro-magnetic waves along cables was largely due to the work of Prof. A. E. Kennelly, of Harvard University, whom he asked to take part in the discussion.

Prof. A. E. Kennelly, after complimenting Dr. Wall on his paper, said they should be careful to avoid giving voice to criticisms of a plan of the kind dealt with on account of its great novelty, because objections and difficulties were sure to arise in their minds, in view of the experience with the ordinary low-frequency transmissions which they were accustomed to. It was by means of novelties that they were making progress, and it seemed to him that if one did no more than study what might occur on such a system, one was bound to go on learning. This was the first serious proposal that he remembered having seen of power transmission on a considerable scale over fairly long lines at a telephonic frequency, a frequency which would be ordinarily looked upon as a higher harmonic of the working frequency. Proposals had been made to operate at half-wave frequency, but not to adjust to a quarter-wave frequency, so far as he knew; that had been looked upon as a bugbear, something to be dreaded rather than welcomed and entertained. It seemed to him that the

method could be studied effectively in the laboratory, before attempting any serious expenditure, by means of artificial electric lines. This would be relatively inexpensive. He hoped the matter would be carried further, with a view to determining the possibilities of such a method as that indicated in the paper.

Prof. F. C. Lea referred to the author's remark that it was recognised that for total power production the machines must of necessity run at rather low speeds in such a scheme as might be carried out on the Severn. There were considerable limits to the power of the machines, and, therefore, in contemplating the production of a very large number of units of power, and considering that these machines had to run at low speeds, he asked the author whether he still thought there would be an inherent difficulty in that.

Prof. F. G. Baily said that one could not help feeling that this might not be the right application for Dr. Wall's very ingenious idea, but it was very desirable that everybody should put forward ideas for hydro-electric stations with variable frequency and variable supply, so that out of the mass of the proposals it might be possible for engineers to agree to some acceptable proposal.

Dr. Wall, replying to Prof. Lea, agreed that there would still be a large number of machines, but his proposal was to do away with half of the machines proposed by the Ministry of Transport. A system of generating and distributing d.c. entirely had been suggested as an alternative, but there again the expense would be a drawback, and it was not considered advisable.

Notes on the New Electricity Supply Station of the Edinburgh Corporation.

By S. B. Donkin. (*Abstract.*)

Section G.—Engineering.

Immediately prior to the war it was found that the limits of distribution direct from the existing generating stations of the Edinburgh Corporation had been practically reached. It was, therefore, economically desirable for any new plant, or new generating station, to produce h.p., 3-phase a.c. which could be distributed by means of less costly feeders to various sub-stations in the supply area. The Corporation decided that a new site should be acquired, and a station erected at Portobello. The Westbank site secured was only 25 ft. above the sea level, and there was sufficient space for a station having an ultimate capacity of 100,000 kW.

On June 30th, 1919, the Board of Trade allowed the work of the Portobello station to be proceeded with. Three 10,000-kW turbo-alternator sets were to be installed with requisite boiler plant, &c. Roughly speaking, the area to be supplied by the station is bounded by Linlithgow and Bathgate on the west; by North Berwick or Dunbar on the east; and by Penicuik and Gorebridge on the south.

A site was acquired large enough to accommodate sidings sufficient to satisfy the requirements of the railway company, and to enable the Corporation to have room to erect gas-producing and by-product recovery plant should the raising of steam from coal by such a process prove at any time in the future to be economically sound. It was further acquired so as to enable parts of the clay pit on the site to be filled up by ash refuse from the power house when it was in operation.

The author exhibited lantern slides showing the general arrangement of the power station, together with the sidings, and with the sea work for condensing water, also the coaling scheme, and ash duct. Coal will be brought on to the sidings provided on the clay pit site, and the trucks will be emptied by means of a rotary tippler into a hopper below ground level. This hopper will feed a belt conveyor running in a tunnel from the clay pit site to the power-house site. On the power-house site this conveyor will discharge the coal on to another belt conveyor, which in turn will discharge it into hoppers feeding gravity bucket conveyors, which will carry the coal into the bunkers over each boiler house. The belt conveyor from the clay pit site will be able also to tip the coal into a store on the site, from which a travelling jib crane will grab it and distribute and store it over the power-house site. This jib crane will also collect the coal from the site and discharge it into the hoppers feeding the gravity bucket conveyors. The coaling plant is being provided by the Mitchell Conveyor & Transporter Co. and by Messrs. Fraser and Chalmers. The boilers are of the Stirling Boiler Co.'s tridrum type with superposed steel tube economisers. Three types of stokers will be adopted: the Babcock & Wilcox chain grate, the Erith Riley grate, and the Underfeed Stoker Co.'s self-contained travelling grate, all fitted with forced and induced draught fans driven by motors. The steam pressure will be 300 lb. per sq. in., and the total temperature will be 700 deg. F. Six boilers are being provided at present, two being able to provide sufficient steam for one 10,000-kW turbo-alternator. One short steel chimney is provided for every two boilers, and each chimney is designed with a dust catching device at its base. This has been found necessary with induced draught when the poorer classes of coal are used. The turbo-alternators are of Messrs. Brown, Boveri & Co.'s manufacture, and the condensing plant is made by Messrs. W. H. Allen, Sons and Co. As already mentioned, there will be three sets, each of 10,000 kW normal output, but each having a maximum continuous rating of 14,700 kVA. A 70-ton travelling crane will be provided in the turbine house, made by Messrs. Marshall, Fleming & Co., and the h.p. switchgear is being provided by the British Thomson-Houston Co. The whole of the steelwork for the buildings has been carried out by Messrs. Redpath, Brown & Co., of Edinburgh, and the building superstructure by Messrs. J. Angus & Co. The plant for the station, which is at present on order, is such that at normal full load the overall thermal efficiency of the station should be 21.0 per cent., the coal consumption being equal to an expenditure of 16,300 B.th.u. per kWh. The system of boiler house control is based initially on the scheme devised by Mr. Myers, of Sheffield. The proposals are somewhat novel, and are, therefore, referred to in detail. The instruments necessary for the general control of a boiler house have been divided into two main groups—the recording instruments and the indicating instruments. The former are placed in a specially-built cabin (one cabin for every two boilers), and the latter collected wherever possible on one board, and placed in a convenient position in front of each pair of boilers. The set of recording instruments for each boiler will be situated on one wall of the cabin nearest the boiler to which they belong. The following instruments are proposed for each boiler: Indicators.—Steam flow meter indicator; feed-water meter indicator; coal meter; CO_2 indicator; draught gauge indicator for forced and induced draught; steam pressure gauge; steam temperature indicator; differential draught gauge connection above and below each grate. Recorders.—These include recorders for the indicators and recording thermometers in economiser inlet, economiser outlet on water side, and on flue gas side.

Generally for each group of boilers in one boiler house there will be: A blow-down recorder with chart; a densimeter for the blow down; and a feed-water recording thermometer. For every group of two boilers feeding one turbine there will also be on the indicator board beside the two boilers a kW meter to indicate the load on the turbine fed by these two boilers. The coal consumption indicator and recorders are proposed to be of the type introduced by the Lea Recorder Co., and will measure the rate of flow of coal passing on to any grate in a given time with means of adjusting the ratio of weight to volume to suit any type of coal in use. It is proposed to degas the condensate, plus the make-up, to take out all oxygen from the water so as to render internal corrosion of boilers or economisers improbable. The use of by-product recovery plant can be undertaken without much alteration to the boiler plant, and will be advised whenever it is profitable to undertake the additional expenditure.

The author described the system starting from the sea to the pump house and the pipe system through the condensers and back to the sea. Two tunnels will be normally used for suction and one as discharge; one of the two suctions can be stopped and changed over to act as a discharge, and the pipe previously discharging can then be used as a second suction. There will be grids for the prevention of entry of fish or seaweed; these will be washed clean by reversal of flow, and the material carried back to the sea. A duplicate system of tunnels and pipes across the site will split up the system as much as possible to prevent a shut down.

Experience in the past on the banks of the Thames proved that the cost of the tunnelling scheme was less than the cost of laying pipes down the foreshore into the water, because so much of the system had to be carried out below low-water level, and this could only be done by means of a dam to keep the water back while the work of construction and laying of the pipes was being carried out. The actual cost of the tunnelling work now under construction works out at £28 per yard run of the tunnel, excluding the cost of the shafts. The sea work shafts and tunnels are being carried out by Messrs. C. Brand & Son, of Glasgow, and Mr. H. H. Dalrymple Hay has been joint engineer with Sir Alexander Kennedy and the author, in connection with the design and construction of the work.

The Element of Compulsory Arbitration in Recent Industrial Legislation.

By Dr. Mary T. Rankin. (*Abstract.*)

Section F.—Economics.

The legislation dealt with is the Trade Boards Act, 1918, and the Industrial Courts Act, 1919. These Acts were passed for the purpose of giving effect to certain proposals for the reorganisation of industry contained in the Whitley Reports, and must therefore be considered from this point of view. The Whitley Reports, while professedly aiming at the self-government of industry, advocate the principle that State "assistance" should vary inversely with the degree of organisation in each industry (cf. second Whitley Report). The Trade Boards Act, 1918, was the method adopted for providing this "assistance." The Act may be applied to any trade or part of a trade merely at the discretion of the Minister of Labour. State regulation may thus supersede and must conflict with the principle of self-government. Similarly, the Industrial Courts Act, like the Whitley Report, contemplates and encourages a vast increase in appeals to Government arbitration in trade disputes. No Act of such a nature can retain a purely voluntary character.

THE SHIPPING, ENGINEERING, AND MACHINERY EXHIBITION.

(*Continued from p.* 371.)

The Record Engineering Co., Ltd., shows four models, all built in accordance with its standard design. Fig. 7 shows a 16-kW ship's emergency lighting set, consisting of a "Silent Record" paraffin engine coupled to a 16-kW Sunderland Forge Co.'s dynamo. The engine is of the 2-crank type running at a speed of 650 r.p.m. All working parts are fitted with forced lubrication, and the cylinder heads are removable, this being the standard practice for all sizes of engines. A 2½-kW electric lighting set is shown running on town gas. These sets are made for petrol, paraffin, town, or suction gas, and in sizes from 1½ to 250 b.h.p. An interesting engine fitment is also exhibited by this company, viz., the S.A. impulse starter (fig. 8), which is a standard fitment to any magneto. It is easily fitted, and does not ocupy more space than the ordinary standard magneto coupling. The construction is

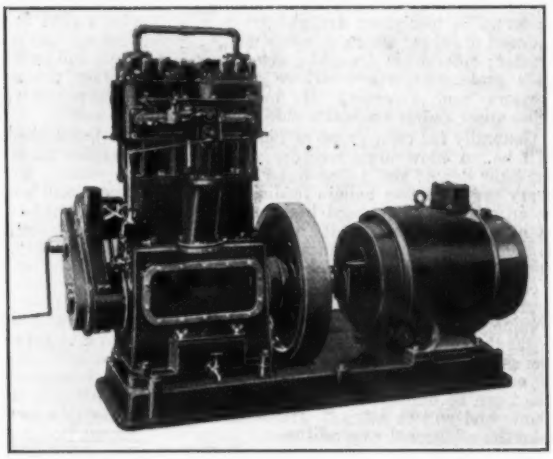


Fig. 7.—A 16-kw Silent Record Emergency Ship's Lighting Set.

simple, and once the engine is started the action is that of an ordinary magneto coupling. Accumulators are not required. The principle upon which the mechanism of the starter operates is as follows: The magneto armature is temporarily arrested by the action of pulling the pawl into engagement with the armature-plate which is attached to the armature spindle. The action causes the spiral spring inside the starter to be wound up and as a result energy is stored in the spring until such time as the cam on the cam casing disengages the pawl from the armature plate. As soon as disengagement takes place the energy stored in the spring imparts a rapid

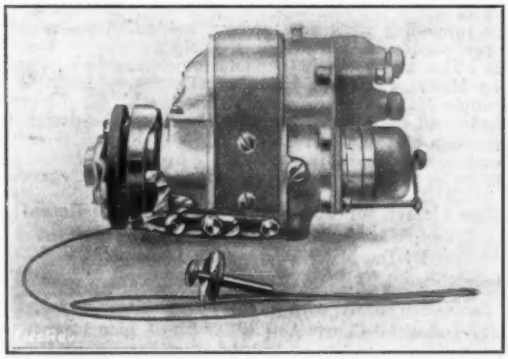


Fig. 8.—The S.A. Impulse Engine Starter.

impulse to the magneto armature, equivalent to revolving the armature at 500 r.p.m.; this produces an intense spark in the cylinder which is on the firing stroke. The spiral spring is so arranged that after the impulse has taken place the armature plate and cam casing are spring locked, thus forming a rigid lock, so that the ordinary timing of the engine and magneto is maintained and the starting device then functions purely in the manner of an ordinary coupling. The pawl-operating mechanism is so arranged that immediately the engine revolves under its own power, the pawl is thrown out of operation, and its design is such that the starter cannot come into operation after the engine is running due to the pawl being arranged in such a manner that it comes under the magnetic influence of the magnets of the magneto, which keeps it in position until such time as it is operated by the pull-button.

The British Thomson-Houston Co., Ltd.—Certain items of special interest to the shipping and kindred engineering trades have been selected for this exhibit, of which the following may be detailed: The portable master controller for cranes enables all operations of the crane to be controlled from the deck or dockside where full view of the load is obtained during all stages of loading or discharging cargo. One man only is required, carrying the controller by means of straps over his shoulders and moving to the most suitable position from which he can control the load. The controller is connected only by a light trailing cable to contactors mounted on a panel which is placed in a convenient position in the crane cabin. The B.T.H. electric rivet heater has been designed to overcome the waste which is generally recognised in existing methods of heating rivets. The rivet heater consists primarily of a portable iron framework which supports a compact air-cooled transformer, the primary of which is connected through a six-tap drum controller to the a.c. supply. The secondary of the transformer is connected to two movable copper electrodes which can be raised or lowered by means of foot pedals so that rivets may be held between these electrodes and a fixed copper block extending below the two electrodes. The rivets are heated by placing them in a vertical position between the electrodes and the copper block, the whole of the current passing through the rivets in parallel. Six heats, from "low" to "high," can be allowed by means of the drum controller on the primary of the transformer, to allow for various sizes of rivets or the rate of output required. There is no danger of "shock" because the maximum potential across the electrodes does not exceed 5 volts. Heated rivets can be produced at the rate of about 5-lb. per kWh. Electric motors for a.c. and d.c. circuits are represented by an exhibit of one of each type, both specially designed for marine use. Special marine type bearings are fitted, each with two oil rings, and allowing a movement of 15 deg. in either direction from the vertical positions. The double master controller for use with cranes and similar machinery controls two motors at the same time, allowing both travel and traverse motions to be controlled by a single lever. The controller consists of two small barrels combined in one frame, both being operated by the same lever through universal gear. Another interesting exhibit in control gear is the watertight controller rated at 10 h.p., 200/550 volts, and has five points forward and reverse. A pedal switch for electrically-operated capstans, winches, &c., allows the operator to have both hands free. The pedal plunger passes through a watertight gland, and when the switch is assembled on the capstan pit cover it is impervious to rain and sea water. When out of service, the plunger can be disengaged from the operating mechanism and dropped flush with the surface of the switch. When in this position the pedal can be locked by inserting a key in the top of the plunger, thus protecting the apparatus from misuse. Flow meters for steam, gas, air, water, or oil, demonstrate the waste-checking value of these simple instruments. A portable wireless receiver shown is a complete unit, weighing only 20 lb., in a case measuring 13 by 14 by 5 in., and it does not require an external aerial or other wires. All that is necessary with this instrument is to stand the box on a pivot on the detachable cover, connect the telephones, and by simple adjustment "tune" the apparatus to the vibrations of the passing wave. The signals are sufficiently loud to enable messages to be taken from stations in France and Germany, and the direction of origin of the signals is indicated by the instrument.

Messrs. Pooley & Austin.—In addition to a range of standard a.c. and d.c. motors, the firm shows several interesting novelties. One of these takes the form of a semi-portable chain-driven blower suitable for removing dust, &c., from the inside of motors, dynamos, switchgear, and other similar apparatus, or for use with a portable forge or brazing hearth. The motor is mounted directly above the compressor, the floor space occupied being no more than that taken by the compressor alone, and the set can be easily carried about by one man. In a Wilson-Wolf fractional horse-power motor is incorporated a reduction gear with a ratio of 28-1, the second motion shaft being in line with the armature shaft and revolving in the same direction, the reduction gear being mounted in the pulley end bracket of the motor; other motor combinations are shown, and the motor-generator set converting single-phase a.c. to d.c. for supplying all the d.c. required on the stand is of the "Creedy" compensated commutator type. The electric wiring installation of the stand for the whole of the lights and motor circuits is carried out in C.T.S. cable manufactured by the Greengate & Irwell Rubber Co., Ltd. Amongst the switchgear included in this exhibit is a variety of Park Royal Engineering Works, Ltd., specialities, including a motor car switchboard of special design. The d.c. motors shown are Messrs. Mawdsley's, Ltd., and embody the Mawdsley method of field magnet construction, which is claimed to represent an advance on the ordinary interpole type.

A comprehensive display of electrical apparatus of all kinds is to be seen on the stand of the N.V. Hengelosche Electrische en Mechanische Apparaten-Fabrick, of Holland (Agents: Messrs. Williams, Pell & Baring). The centre of the stand is occupied by a switch desk (fig. 9) for the control of the generator units of a high-pressure three-phase power station. The Heemaf desk is of the unit type, lending itself

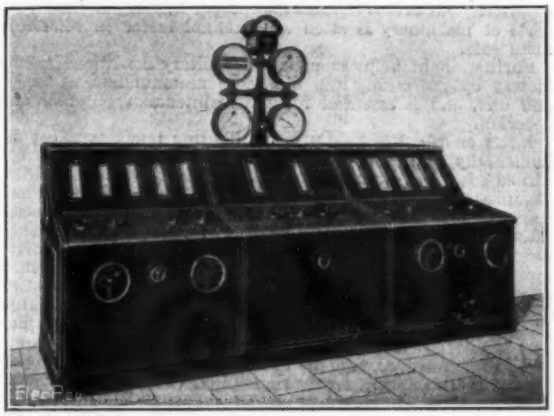


Fig. 9.—Heemaf Control Board.

readily to the extension of the number of generator or supply circuits which may be required. It is constructed of steel plate panels with nickelled corners and framework, and is mounted with flush fitting instruments, control switches, regulators, and indicators. The example shown has been constructed for an installation in the Dutch East Indies, and comprises two generator and synchroniser panels; the generators each have a capacity of 2,500 kW at 3,500 volts. The voltmeters, amperemeters, and kilowattmeter for the generator and exciter are of the flat scale edgewise type, mounted flat

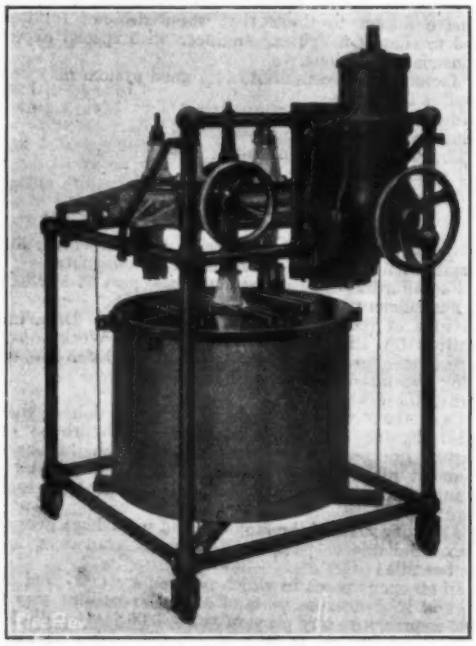


Fig. 10.—Heemaf H.P. Oil Switch.

in the upper panels. On the table part of the desk are push-button switches for operating electrically-actuated oil switches and indicating lamps, also a synchronising plug. On the lower panels are main and shunt regulators for the exciters, and special regulator for adjusting the engine speed while synchronising. At the back of the desk are integrating kilowatt-hour meters. The centre section is used for synchronising and has mounted on it a pillar, voltmeter, periodicity indicator, synchronoscope, balance voltmeter, and an automatic synchroniser by means of which the generators can be synchronised automatically, independent of the skill of the attendant. This centre section also contains an ammeter and voltmeter, relay switches, indicators, and a regulator for a small rotary converter used for supplying d.c. to the auxiliary circuits for operating the oil switches. The connections are run inside the desk in a neat and substantial manner, all wire ends being marked clearly to assist re-erection.

With the Heemaf automatic synchroniser it is imperative that electrically-operated auxiliary switches be used for connecting both machines or systems in parallel. The apparatus is very simple and consists essentially of two Ferraris aluminium disks, each provided with a pointer. One of the disks is subjected to the magnetic force of two peculiarly shaped magnet systems, which produce a rotating field by current taken from each of the two machines to be synchronised. The magnetic fields produced by these coils when synchronism is reached have a phase displacement of 90 deg., thus placing the disk against the action of an increasing force in its extreme position. Against this magnetic force acting upon a disk, the action of a spring is exerted which tends to bring the pointer back to its central position. As soon as the pointer reaches the extreme position, it closes an auxiliary circuit which, in turn, energises the various control circuits for operating an oil switch to connect the incoming generator. By using this synchroniser it is claimed the angular displacement between phases of the two machines to be synchronised cannot exceed 7.4 deg. which corresponds to a maximum current rush of 19 per cent. that only lasts from 1 to 3 cycles, and can hardly be detected on a meter. This clearly shows that the percentage of error when synchronising units is practically negligible. The two pointers will meet only with equality of phase and frequency, and with a predetermined difference of voltage not exceeding 10 per cent.

A model transformer kiosk illustrates a compact and inexpensive design of sub-station for use in street distribution or isolated plant. The kiosk consists of a concrete base with a sheet-steel superstructure mounted on rollers to enable it to rotate and bring the doors opposite to any part of the internal compartments to give access to the fittings and connections as required. In co-operation with Philips lamp works, the company has designed a current rectifier that consists essentially of a double-electrode argon gasfilled valve, a transformer, and an overload release all contained in a neat enclosing case. On the 1.5 and 3-amp. sizes when the cathode filament is burned out the bulb is simply reversed in its fitting so that the other side becomes the cathode; thus the life of the bulb is doubled. An automatic overload switch is used in conjunction with the device in such a way that when the supply of d.c. exceeds a certain value the current is cut off.

Fig. 10 is a reproduction of a h.p. oil switch mounted on a pipe framework with the control mechanism and lowering device for the sheet-steel welded tank.

Messrs. I. & M. Steingold's exhibit consists of preparations and electrically-driven machines for use in the "Simplex" system of treating wooden floors, ships' decks, &c. Planing, sandpapering, and polishing machines are supplied, each of which is operated by an electric motor, and to avoid raising dust or scattering shavings, a hood and suction tube attachment is provided.

The London Electric Firm has on view searchlights and projectors of various sizes and types, also current-carrying cable drums, lamp-lowering gear and winches, small d.c. motors and dynamos, &c. The soldering-iron heating oven that was described and illustrated in our last issue is shown in addition to electric irons, kettles, and other heating apparatus that is made by the company's branch firm, the Electric Heating Co. It should be mentioned that a speciality is made of low-voltage apparatus to suit conditions prevailing on board ship.

Mr. W. Hamilton Wilson's stand contains a selection of wireless telegraph transmitting and receiving apparatus, an X-ray spark coil, and various transformers, condensers, and thermo-electric instruments for the measurement of small a.c. currents, radiation, and temperature measurements, &c.

The Radio Communication Co., Ltd., also exhibits devices of this nature, including emergency equipment; the sets range in power from ¼ to 5 kW, one of the former size being portable, is designed for use on lifeboats, and has a range of 60-80 miles.

The products of Messrs. Ozonair, Ltd., by the aid of which pure ozone is produced electrically are too well known to need detailed description. Plant of various sizes is shown.

The models on the stand of Messrs. Hydraulic Gears, Ltd., illustrate useful and interesting applications of the Hele-Shaw variable delivery pump to ships' gears, allowing, as it does, the electric driving motor to run continuously, and protecting it from the severe shocks of the sea. The pump acts on hydraulic rams connected to the tiller, and the gear constitutes a closed hydraulic system in which the operating fluid is oil. It is operated by means of a telemotor from the bridge, is under perfect control, and quick to respond.

The Sperry Gyroscope Co., Ltd.—The instruments on this stand are always attractive on account of their delicacy and the beautiful way in which they are made. The gyro compass and high intensity searchlight have been described in our pages; the former has been adopted as standard in all the Allied Navies, and since the war the merchant service has used it with satisfactory results. The odograph is another electrical instrument (invented by Admiral Villiers, of the British Navy) that combines the readings of the gyro

compass and the electric log, and traces on a sea chart the actual course traversed by the ship.

Messrs. S. G. Brown, Ltd., show a gyro compass of equal interest to that mentioned above; it has also been described in our columns. Wireless telephone devices, electrical and cable instruments, and the "Cyclux" self-generating lighting set for bicycles are also exhibited on this stand.

Medway's Safety Lift Co., Ltd., demonstrated a complete electric passenger lift controlled by push buttons as well as by a switch worked by the attendant in the cage. The firm's electrically-operated device for opening and closing lift doors and gates is operated by merely pressing a button, and is practically noiseless in operation.

Electric soldering irons (Wheatcroft's patent applied for) are to be seen on the stand of Messrs. Ellis & Coe, their feature being that the bits are renewable without having to dismantle the iron itself.

Another type of iron is shown on the stand of Acme Ateliers (Jean Lieber) de Constructions Mecaniques, of Switzerland (Agent, Mr. E. Fehr), and has the copper bit screwed to the head of the iron so that bits can be changed from one position to another as required.

The Telephone Manufacturing Co., Ltd., claims to cater for the needs of all and sundry, whether it be for shipyard, ship, office, works, warehouse, private house, or other uses, and it accordingly exhibits a large and varied assortment of its products.

(To be continued.)

ELECTRICITY IN COAL MINES.

A conference was recently held between the Switchgear Section of the B.E.A.M.A. and Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, with regard to the rules governing the construction and use of switchboards in mines; Dr. Garrard, chairman of the Switchgear Technical Committee, was in the chair. As some of the matters for discussion also had their counterpart in factory switchboards, H.M. Electrical Inspector of Factories, Mr. G. Scott Ram, was also invited to attend.

After Mr. Ram had explained the bearing of the factory regulations on the points in question, Mr. Horsley dealt with the requirements of the mines rules, and called attention to the information contained in "Mines and Quarries Form No. 11 (April, 1921)," which contains the electricity regulations and the revised official memorandum thereon.

After full discussion, it was agreed to place on record the following views:—

1. *The Isolation of Circuit-breakers for Cleaning or Repairs.*—In colliery surface switchboards, when a switchboard circuit comprising air-break circuit-breakers or contactors cannot be shut down regularly, say, once a week, exclusive of Sundays, to permit of cleaning and adjustment being carried out with safety, means must be provided for isolating such circuit-breakers or contactors.

2. *Screening.*—In view of the foregoing rule, provision for fixed or movable partitions may or may not be necessary, depending upon the nature and design of the switchboard.

3. *Insulating Barriers.*—When a switchboard has open-type bus-bars arranged in the horizontal plane, insulating barriers must be fixed between them projecting at least 2 in. above the upper surface of the bus-bars.

4. *Shrouded Circuit Contacts.*—When a surface switchboard contains cut-outs having surface contacts fixed on the front, and the distance between opposite poles is less than 6 in., such contacts must either be shrouded or protected by fillets provided between the poles.

LIGHTING IN FACTORIES AND WORKSHOPS

The following is an abstract of Welfare Pamphlet No. 7, issued by the Home Office (pp. 20; illustrated. H.M. Stationery Office. Price 4d. net):—

1.—The Importance of Lighting.

The lighting of a factory or workshop is a matter which should receive the special consideration of every occupier, since it has an important bearing both on the health, safety, and efficiency of the worker, and on the general efficiency of the work. Since 1913 the subject has been extensively studied by the Departmental Committee on Factory Lighting, which has issued two reports.*

Effect on the Worker.—Complaints as to eyestrain and headaches attributed to insufficient light are common. Few conditions have a more mentally irritating effect than those associated with bad lighting, whether the badness is due to inadequacy or to glare and shadow, and a worker continuously subjected to such conditions clearly cannot be expected to work at his maximum efficiency.

Lighting is undoubtedly an important factor in accident incidence. A statistical investigation carried out by the Departmental Committee on Lighting in Factories and Workshops indicates that accidents of certain types occur more frequently during the winter months when daylight hours are short.* It is also obvious that proper lighting of dangerous parts of machinery is often an essential factor in rendering them safe.

Further, light helps to maintain sanitary conditions in the factory by preventing the unnoticed accumulation of waste and dirt, and is essential for the maintenance of order and decorum.

Effect on the Work.—Defective lighting tends to affect detrimentally both the *quality* and the *quantity* of the work turned out. The former point is self-evident, as proper critical examination of the work by the worker is impossible without sufficient illumination. This principle is already usually recognised for processes of special delicacy, for which care is taken to secure adequate illumination just as care is taken to provide proper tools. Still, even here, it is doubtful whether sufficient attention is always given to the requisites of good lighting other than mere adequacy—for example, shading and relative position of light sources and work. In the case of less fine and coarse processes, the importance of good lighting is apt to be overlooked, though its effect in diminishing the proportion of spoilt or defective work is often considerable. Again, defective lighting may affect output *quantitatively*, though, of course, in different degrees according to the nature of the work. Some part of an operation may be slightly delayed at every performance owing to imperfect lighting, and if the operation is repeated thousands of times daily, the cumulative effect of these delays will be very large.

Broadly, therefore, illumination, to be satisfactory, must fulfil the following conditions:—

(*a*) That there are no lighting conditions prejudicial to the health, comfort, and safety of workers.

(*b*) That it is sufficient for the proper carrying out of the work both as regards quality and output.

2.—Fundamental Requisites of Good Lighting.

The conditions determining whether a given system is satisfactory or not are so complex, and vary so much with the class of work carried on, that it is impossible to do more than enunciate certain fundamental principles, and occupiers who have reason to think that these are not fulfilled are advised to consult a lighting engineer with special experience of industrial conditions.

The factors which contribute to a good system may be summarised as follows:—

1. Adequacy.
2. Suitability, comprising:—
(*a*) Constancy and uniformity.
(*b*) Prevention of glare.
(*c*) Avoidance of shadow.

1. Adequacy.

For most workrooms it is necessary to consider the amount of illumination that may be regarded as adequate:—

(*a*) For affording safe access from one part to another.

(*b*) For efficient carrying on of the work.

The first of these has been studied by the Departmental Committee on Lighting in Factories and Workshops, and numerical standards have been recommended for adoption as fulfilling the *minimum* requirements.

Briefly, these are:—

(*a*) Over the "working area," or that portion of the floor occupied by or in the immediate neighbourhood of the machines, benches, plant, or material at which the operatives stand or sit in execution of their work, including the gangways and alleys between or around such working places,† 0.25 foot-candle.‡

(*b*) All other parts of the factories and workshops over which persons are liable to pass, *e.g.*, passages, stairways, lobbies, 0.1 foot-candle!

(*c*) In all open spaces in which persons are employed during night, and in dangerous parts of a regular road or way forming the approach to any place of work, 0.05 foot-candle.‡

These standards are to be regarded not as embodying ideal conditions, but as suitable for legal minima. Owing to the diversity of illumination existing with any system of lighting, a given minimum means a much higher maximum and average.

2. Suitability.

A more common fault than inadequate lighting is its *unsuitability*, due generally to inattention to one or more of the points described below.

(*a*) *Constancy and Uniformity.*—A flickering light is always a cause of irritation and may cause accidents.

* First report of the Departmental Committee on Lighting of Factories. Vol. I. Report and appendices. (Cd. 8,000), 1915. Price 11d. Second report of the Departmental Committee on Lighting in Factories. (Cmd. 1,418), 1921. Price 1d.

* See first report, p. xii.

† An exception is made in the case of iron foundries, for which, owing to the dark surroundings and want of contrast a standard of 0.4 foot-candle is recommended.

‡ The measurements are to be made on a horizontal plane at floor level.

Attention may also be drawn to the importance of adequately lighting the *whole* of the plane of work, including parts regularly but infrequently used. For instance, whilst the work may be excellently lighted, the place where the tools are kept ready for use is neglected, and time and temper are lost on every occasion when a change of tool or materials is required.

Uniformity of lighting is especially necessary on machine work which requires the operative to give attention to more than one small part of the machine.

(*b*) *Prevention of Glare.*—The term *glare* may be used to cover any of the following phenomena:—

(i) The effect of looking directly at a bright source of light, so that the worker is prevented from seeing other objects properly. Vision is impaired for a short period after the light has ceased to enter his eyes.

(ii) The effect which is produced by the presence of bright sources of light towards the edge of the field of vision. A worker may never look directly at such sources of light, but is nevertheless troubled by their presence. This is the commonest form of glare.

(iii) The effect which is produced when the surface being worked upon is shiny or polished, and reflects light directly from some source into the eyes of the worker.

The first two of these forms of glare can be avoided either by the proper shading of the light sources or by fixing them at a sufficient height above the worker.

It is still common to find shallow shades which were suitable for the small electric lamps for which they were originally made, used for the modern type of large bulbs which extend far beyond the shade and dazzle the eyes when hung in the direct line of sight.

The third form may be remedied by suitable adjustment of the light source or by shading with translucent material.

(*c*) *Avoidance of Shadow.*—The shadow may be that of the worker himself, of parts of the machinery or plant, or of the material being worked upon. The remedy consists either in suitable shading or adjustment of the lamp, or in increasing the illumination over the part of the plane of work affected so as to neutralise the shadow.

3.—Natural and Artificial Lighting.

Two separate problems in illumination have to be considered, one relating to the natural and the other to the artificial lighting, though the same fundamental principles apply to both.

The two problems are quite distinct; in natural lighting the positions of the sources, *i.e.*, the windows, are definitely fixed, whereas in artificial lighting there is almost unlimited scope in the arrangement of sources.

4.—Methods of Artificial Lighting.

The methods of artificial lighting of workrooms may be classified as follows:—

1. General lighting, whereby an illumination is produced which is approximately uniform throughout the whole room.
2. Localised general lighting, whereby an illumination is produced which is approximately uniform over a portion or portions of the room in question.
3. Local lighting, with the object of lighting some particular portion of a machine or locality by an arrangement of individual lamps acting independently of one another.
4. Combined local and general lighting.

[Examples of alternative methods are given, with illustrations.]

Where general lighting is adopted, there is little risk of the floor being insufficiently illuminated. With localised general lighting there is danger of some parts being neglected, whilst with local lighting the contrast between the brightly illuminated work and the comparatively dark surroundings necessitates careful attention to the general lighting.

5.—Causes of Unsatisfactory Lighting.

The principal causes for unsatisfactory natural lighting may be classified as follows:—

1. Old and unsuitable buildings.
2. Obstruction of light.
3. Dirty windows. A very common cause of insufficient illumination, and arrangements should be made for periodical cleaning, as is already the practice with many firms.
4. Dirty walls and ceilings. This effect is specially marked in factories lighted from saw-tooth roofs, where much of the light entering the windows is reflected from the sloping ceiling down on to the work.

The effect of light-coloured walls and white ceilings on the general brightness of the room and in affording an effective background to dark objects is often overlooked, and special attention should be directed to this means of increasing the illumination in workrooms at a minimum of expense.

(1) and (2) are specially noticeable in large towns where space is limited, and cannot be completely removed without rebuilding or change to another factory. Additional daylight may be secured thus:—

1. The windows should be of adequate size and extend to as near the ceiling as practicable.
2. They should be kept clean, and free from unnecessary obstruction within.
3. Vertical light can be reflected into the room by means of reflectors or prismatic glass.
4. It may be possible to whiten the surface of an external wall or building which obstructs the light.
5. The inside walls and ceiling should be white or nearly white.
6. The positions of the permanent working points should be so adjusted in relation to the windows and to internal obstructions of whatever kind to secure as far as practicable adequate daylight for each.

The chief causes of unsatisfactory artificial illumination may also be classified under a few headings:—

1. *The Provision of too few or too weak Light sources.*
2. *Antiquated Methods of Lighting.*—As a rule, the methods now adopted are modern and efficient, but instances are still found of the use of antiquated systems. Gas jets are objectionable in many ways—they vitiate the air, are liable to flicker, and are so uneconomical that the small capital outlay required to replace them by a modern system is rapidly repaid by the greater efficiency and diminution in running expenses.
3. *Inadequate Supply.*—Inadequate illumination is sometimes caused by the diminished pressure in the gas mains during the period of maximum consumption, and, where the electrical energy is generated on the premises, by the installation of a dynamo or engine of insufficient output.
4. *Neglect of Upkeep.*—Systematic attention to the light sources is always necessary in order to obtain maximum efficiency.
5. *Inside Obstruction.*
6. *Shadows and Placing of Lights.*

6.—Illumination Required for the Actual Work.

Perception of Detail.—The illumination required for the work itself varies so much with the nature of the process that every process has to be considered on its merits, and depends not only on its nature and the degree of detail to be made visible, but also on the reflecting power of the material worked on; further, after a certain limit is reached increase of illumination has no effect in assisting the eye to distinguish detail.

Direct and Indirect Lighting.—Modern methods of artificial illumination are commonly divided into three classes:—

Method.	*Application.*	*Suitable types of lamp.*
(1) Direct	(*a*) General Lighting	Single low candle power gas-filled or high candle-power metal filament (single or in groups) in shades or enclosed fittings.
	(*b*) Local Lighting	Single low candle power metal filament in shades.
(2) Semi-Indirect	General Lighting	Single high candle power gas-filled.
(3) Indirect	General Lighting	Single high candle power gas-filled.

The principal distinction between these systems is that in the direct system the light emanates from points, and in the indirect from surfaces, whilst the semi-indirect system is a combination of both.

The conclusion indicates, in the form of questions, the various ways in which the lighting of a factory may be defective. Appendix I is extracted from the First Report of the Departmental Committee already referred to, and deals with "Illumination and its Measurement," while a second appendix shows by means of excellent reproductions examples of bad and good lighting.

A Glasgow Sale.—Our local correspondent writes:—"A three days' sale of machinery including 200 generator sets, and 500 searchlight projectors, was conducted at Georgetown Factory, near Glasgow, by Mr. Matthew Marshall, Waterloo Street, by direction of the Disposal and Liquidation Commission last week. Buyers were present from industrial centres in England and Scotland, while firms in Natal were also represented. Throughout the three days of the sale there was keen competition. The prices realised were highly satisfactory and compared favourably with those current months ago, notwithstanding the slump in trade. Four-hundred and thirty-two small switchboards for 60 cm. projectors, containing voltmeter, ammeter, knife switch, &c., £864; 15 No 3 Herbert combination lathes, with fittings, about £400; a 5-ton electric overhead crane, with lifting, travelling, and traversing motions, controlled from the ground level, with motors of 220 volts, d.c., £355; 6 in. submersible electric pump, complete with oil-driven alternator, 220 volts, output 350 tons p.h., £225; 3-ton crane, with 60 ft. steel jib, fitted for motor drive, £200; 30-h.p. electric motor, by Laurence Scott & Co., £160; 50-h.p. electric motor, d.c., 220 volts, totally enclosed type, £125; 30-h.p. electric motor, d.c., 220 volts, with pulley, £120; a 30-cwt. electrically driven winch, with parallel drum, fitted with Westinghouse motor of 15 h.p., 400 volts, £100; 24-kW generating set by Boothroyd, £100; 507 parabolic reflectors for 60 cm. projectors, £100."

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

23,245. "Condensate ejectors." Metropolitan-Vickers Electrical Co., Ltd. September 1st. (United States, October 22nd, 1920.)
23,246. "Liquid rheostats." Metropolitan-Vickers Electrical Co., Ltd. September 1st. (United States, October 18th, 1920.)
23,253. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 1st.
23,260. "Sound signalling systems." H. Baron (Signal Ges.). September 1st.
23,261. "Electron discharge amplifiers." British Thomson-Houston Co., Ltd. September 1st. (United States, October 29th, 1913.)
23,264. "Electrically heated soldering iron." A. Albrecht and J. Albrecht. September 1st. (Switzerland, May 10th.)
23,285. "Aerials for wireless signalling." T. L. Eckersley, A. McLellan, and H. J. Round. September 1st.
23,288. "Means for fixing insulator, &c., bolts." W. F. Ennis. September 1st.
23,291. "X-ray appliances." M. R. J. Hayes. September 2nd.
23,294. "Electric traction." R. C. Sayer. September 2nd.
23,302. "Electric filament lamp holders." W. W. R. F. Griffiths. September 2nd.
23,314. "Electric motor." W. C. Fairweather (Diehl Manufacturing Co.). September 2nd.
23,315. "Motor attachment for sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,316. "Motor-driven sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,317. "Electrically-controlled sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,318. "Lighting attachment for sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,319. "Electrically-lighted sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,320. "Electric sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,321. "Electrical connectors and terminal blocks." W. Fairweather (Singer Manufacturing Co.). September 2nd.
23,345. "Mechanical relays." A. Barr, Barr & Stroud, Ltd., and W. Stroud. September 2nd.
23,349. "Electric apparatus for waving hair." G. Boudou. September 2nd. (France, March 26th, 1920.)
23,376. "Electric discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). September 2nd.
23,377. "Means for rectifying low-tension alternating currents." W. H. Frith. September 2nd.
23,404. "Electrically-operated brakes for self-propelled vehicles." W. Paddon. September 2nd.
23,419. "Telephone systems." E. A. Graham. September 2nd.
23,434. "Electric batteries or accumulators." W. H. Exley and G. H. Handasyde. September 2nd.
23,437. "High-frequency telegraphy and telephony." Ges fur Drahtlose Telegraphie. September 2nd. (Germany, September 29th, 1920.)
23,451. "Electrically-heated utensils." A. G. Bratt. September 3rd.
23,452. "Insulating blocks for lamp holders." A. B. Goldsmith and Proprietary Smallwares, Ltd. September 3rd.
23,453. "Holders for electric lamps." A. B. Goldsmith and Proprietary Smallwares, Ltd. September 3rd.
23,469. "Combined collector and terminal block." W. P. Thompson (Splitdorf Electrical Co.). September 3rd.
23,476. "Testing points for use in electrical work." G. S. Wilson. September 3rd.
23,501. "Permanent magnets for electric machines." C. F. Dufaux. September 3rd. (Switzerland, September 7th, 1920.)
23,518. "Terminal blocks for electric conductors." A. Kirk and R. C. Milliken. September 3rd.
23,523. "Switch for controlling electric circuits." W. J. Pritchett. September 3rd.
23,535. "Composition for screening X-rays and for electrical insulating." R. J. Reynolds. September 3rd.
23,537. "Cycle electric lighting sets." W. H. Bentley-Humphries. September 5th.
23,539. "Commutators or distributors for electric ignition systems." F. W. Baker. September 5th.
23,579. "Signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. September 5th.
23,594. "Miners' electric safety lamps." A. P. Ford. September 5th.
23,604. "Armatures of direct-current electrical machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. September 5th.
23,610. "Frictional driving gear for dynamo-electric machines on railway vehicles." E. C. Astington, E. T. Flann, and Vickers, Ltd. September 5th.
23,612. "Electric switches." British Thomson-Houston Co., Ltd. (Genera Electric Co.). September 5th.
23,617. "Frictional driving gear for dynamo-electric machines on railway vehicles." E. C. Astington, E. T. Flann, and Vickers, Ltd. September 5th.
23,633. "Electric switches for railways, &c." W. S. Every. September 5th.
23,640. "Electric heating apparatus for waving hair." E. F. Suter. September 5th.
23,648. "Dimming devices for electric lighting on vehicles, &c." H. J. Besford. September 6th.
23,668. "Fittings for electrical conduits, steam pipes, &c." J. A. M. Polson. September 6th.
23,676. "Dynamo-electric machines." Electro Dynamic Construction Co., Ltd., and N. Pensabene. September 6th.
23,686. "Commutators." T. A. Tembrey. September 6th.
23,694. "High-tension apparatus." M. A. Codd. September 6th.
23,699. "Spark testing device." J. R. Robertson. September 6th
23,703. "Connections for securing sparking plugs to their leads, &c." G. H. Ward and W. L. Yeo. September 6th.
23,710. "Electric radiators, &c." Metropolitan-Vickers Electrical Co., Ltd., and J. A. Orange. September 6th.
23,725. "Galvanic cells and batteries." R. Haddan (Meier). September 6th.
23,730. "Electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. September 6th.
23,731. "Flexible conductor connectors." British Thomson-Houston Co., Ltd. (General Electric Co.). September 6th.
23,760. "Automatic selectors, &c., for wireless signalling systems." H. R. Rivers-Moore. September 6th.
23,782. "Timing switches or commutator devices." W. P. Thompson (Nelson Timer Co.). September 7th.
23,790. "Directional wireless systems and apparatus." H. L. Crowther, T. H. Gill, G. P. Grenfell, J. Erskine-Murray, and J. Robinson. September 7th.
23,791. "Electric accumulators." W. Whitehead. September 7th.
23,796. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd., T. C. Jordan, and S. R. Smith. September 7th.
23,836. "Magneto ignition for internal combustion engines." C. F. S. Houston, F. A. Schmidt, L. V. Sleeman. September 7th. (Australia, September 7th, 1920.)
23,861. "Telephone junction or terminal boxes, &c." H. J. Palmer. September 7th.
23,869. "Automatic switching arrangements." H. Baron (F. Allendorff). September 7th.
23,872. "Circuits and electromedical apparatus for transforming and utilising electric currents." General Electric Co., Ltd., B. S. Gossling, H. B. Gough, and Watson Sons (Electro-Medical), Ltd. September 7th.
23,891. "Arrangements of cables and transformers in electric high-tension transmission lines." A. M. Taylor. September 7th.
23,895. "Electrical transmission systems." A. M. Taylor. September 7th.
23,898. "Electrical automatic clock." A. C. Glover and H. Unwin. September 8th.
23,912. "Electric rotary contact maker." R. Silcock. September 8th.
23,938. "Electric irons." C. W. Denny. September 8th.
23,953. "Protective devices for electric transformers." Metropolitan-Vickers Electrical Co., Ltd., and T. W. Ross. September 8th.
23,954. "Electro-magnetic regulating devices for dynamo-electric machines." J. Etchells and Vickers, Ltd. September 8th.
23,962. "Apparatus for damping third higher harmonic wave in three phase transformers." Akt.-Ges. Brown, Boveri et Cie. September 8th. (Switzerland, September 15th, 1920.)
23,973. "Sound conducting tubes." Signal Ges. September 8th. (France. September 9th, 1920.)
23,974. "Acoustic apparatus for telephonic communication." Signal Ges. September 8th. (Germany, September 27th, 1920.)
23,980. "Testing devices for electric ignition systems." J. H. Runbaken and W. Torrance. September 8th.
23,982. "Means for operating, from high-tension, direct current, electric mains, apparatus adapted to be operated by low-tension current." L. de S. Zagury (Buscha Ges.). September 8th.
23,996. "Electric fuse boards." J. B. Tucker. September 9th.
24,016. "Electric switch mechanism." H. W. Cox. September 9th.
24,026. "Vacuum tubes and method of making same." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 9th.
24,035. "Means for mounting and driving magneto-electric machines." J. White. September 9th.
24,045. "Circuits for electric heating." A. C. Bartlett and General Electric Co., Ltd. September 9th.
24,057. "Electric arc devices." British Thomson-Houston Co., Ltd. (General Electric Co.). September 9th.

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The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

18,257. "Wireless telegraph apparatus operating with relays." J. B. Bolitho. May 25th, 1920. (168,072.)

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5,988. "Magnetos for the ignition of internal combustion engines." K. F. Ries. February 27th, 1920. (168,080.)
8,026. "Electric lamp holders." British L.M. Ericsson Manufacturing Co., Ltd., H. H. Hayes, and A. A. Godfrey. March 18th, 1920. (168,083.)
10,253. "Rotary transformers and converters for electrical purposes." Accles & Shelvoke, Ltd., and H. F. L. Steventon. April 13th, 1920. (168,092.)
11,109. "Track circuit signalling systems for railways." A. E. Tattersall. April 21st, 1920. (168,104.)
11,182. "Magneto-electric machines." British Thomson-Houston Co., Ltd., A. P. Young, and H. W. H. Warren. April 22nd, 1920. (168,106.)
11,242. "Electroionic relays." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). April 22nd, 1920. (168,107.)
11,560. "Electric welding apparatus." T. E. Murray, Jun. March 2nd, 1919. (142,804.)
13,538. "Thermionic devices." Western Electric Co., Ltd. November 1st, 1916. (Addition to 143,262.) (143,519.)
13,674. "Collectors or commutators for electric dynamos and the like, their manufacture, and means to be employed therein." H. Herrmann. February 27th, 1920. (159,848.)
13,692. "Apparatus for regulating the voltage of dynamo-electric machines." A. J. Jullin. April 30th, 1918. (143,541.)
13,797. "Automatic cut-out devices for electrically-heated appliances for heating or boiling liquids." E. W. Johnston. May 19th, 1920. (Cognate application 36,522, 1920.) (168,128.)
13,839. "Contrivances for applying the metal filament to the carrier in electric incandescent lamps." Sprengstoffwerke, Dr. R. Nahnsen & Co., Akt.-Ges. August 11th, 1919. (149,652.)
13,861. "Means for securing globes, shades and the like to incandescent gas burners, electrical glow lamp holders, and the like." A. C. Jones and S. P. Stubbs. May 20th, 1920. (168,129.)
13,895. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. May 20th, 1920. (168,134.)
14,172. "Dynamometers." Heenan & Froude, Ltd., and G. H. Walker. May 25th, 1920. (168,145.)
14,354. "Means for regulating the speed of electrically-driven rolls such as are employed on paper making machines." A. L. Boyle. May 26th, 1920. (168,152.)
15,792. "Systems of electrical distribution." A. E. White (U.S. Light and Heat Corporation). June 10th, 1920. (168,181.)
16,745. "Lifting magnets." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). June 21st, 1920. (168,199.)
17,858. "Thermionic tube electromagnetic wave amplifying arrangements." Ges. fur Drahtlose Telegraphie. November 16th, 1915. (145,630.)
18,643. "Radio transmission system." Western Electric Co., Ltd. October 2nd, 1916. (146,519.)
18,798. "Telephone sub-station circuits." Western Electric Co., Ltd. September 9th, 1916. (146,880.)
18,844. "Spark plugs." Champion Ignition Co. September 25th, 1918. (146,909.)
18,911. "Telephone sub-station circuits." Western Electric Co., Ltd. August 27th, 1917. (Addition to 146,880.) (146,989.)
19,810. "Moulds for insulating armature conductors." V. G. Apple. May 17th, 1918. (147,782.)
19,819. "Manufacture of armatures for dynamo-electric machines." V. G. Apple. May 20th, 1919. (147,791.)
20,655. "Multiple electric fuses." M. Reichel. December 23rd, 1914. (148,817.)
23,541. "Electric resistance devices." British Thomson-Houston Co., Ltd. (General Electric Co.). August 11th, 1920. (168,238.)
24,683. "Electrically-actuated gongs and like sound-producing apparatus." E. Magerle. February 24th, 1919. (150,350.)
25,172. "System of winding multi-layer electric coils for use as inductances for wireless radio-telegraphy, radio telephony, and the like." W. W. Burnham. September 1st, 1920. (168,249.)
26,035. "Electric controllers and operating mechanism therefor." Electric Control, Ltd., and J. J. Fisher. September 10th, 1920. (168,253.)
26,991. "Electric water heater." W. Colebrook. October 7th, 1919. (152,012.)
28,875. "Electric light fittings." E. Stroud. October 12th, 1920. (Cognate application 30,805, 1920.) (168,263.)
31,284. "Battery ignition and timing devices for internal combustion engines." Bosch Akt.-Ges. R. November 13th, 1919. (153,865.)
31,804. "Process of manufacturing electrical resistance material." Akt.-Ges. Kummler & Matter. November 10th, 1919. (153,602.)

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3,480. "Method of cleaning sparking plugs." J. Chabrolle. January 29th, 1920. (158,575.)